CLASS 585, CHEMISTRY OF HYDROCARBON COMPOUNDS

SECTION I - CLASS DEFINITION

SUBJECT MATTER AND ORGANIZATION OF THIS CLASS

This class provides for a hydrocarbon compound in a pure or relatively pure state and for certain compositions containing hydrocarbons. Methods for making such compounds and compositions by synthesis, blending, etc., and certain methods for treating are also included herein. The scope of this class can be readily determined from a review of the "main line" subclasses of its schedule. These are arranged, in general, following the principles usually applied in the U.S. Patent and Trademark Office for hierarchically ordering statutory subject matter, that is, more complex subject matter or that which exists later in time is generally placed ahead of simpler or earlier subject matter. As applied to chemistry and chemical engineering this ordering is generally as follows:

A. Materials defined by structure.

B. Compositions or mixtures

C. Compounds or elements

D. Manufacturing processes, e.g., synthesis, etc.

E. Nonmanufacturing processes, e.g., purification, etc.

F. Manufacturing apparatus

G. Nonmanufacturing apparatus

This class is confined to categories B, C, D, and E of the above list.

At the heart of this class is the pure compound which consists of carbon and hydrogen and no other element and which has a definite empirical formula and an unambiguous structural formula.

The major portion of patents in this class is drawn to processes for synthesizing such compound from other materials which are not this exact compound, with the intent of recovering the hydrocarbon compound.

Also included in this class, with some exceptions, is a mixture of hydrocarbon compounds, usually closely related in empirical and structural formulae, which mixture results from a single synthesis step, or a series of steps, which mixture is of utility as a mixture, e.g., a "detergent alkylate", a "polymer gasoline", etc. The exceptions are discussed below.

This class also includes, again with some exceptions, a composition which is a deliberate mixture of various hydrocarbons only, such as a fuel or lubricant composition, or a mixture of a hydrocarbon with a nonhydrocarbon material, which nonhydrocarbon material is designed to improve the general utility of the hydrocarbon. Thus, the nonhydrocarbon additive may be a solvent, a preservative, etc.

This class also provides, again with certain exceptions, for methods of manufacturing compounds and compositions classifiable herein and for certain methods of purifying the same or otherwise treating the same.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

This class is the residual class of all Patent Office classes concerned with categories B, C, D, and E listed above. See Class 588, Hazardous or Toxic Waste Destruction or Containment, subclasses 312-321 for the chemical destruction of hydrocarbon hazardous or toxic waste.

When a patent has a claim to subject matter for one of the categories B to E above and another claim to subject matter for another of these categories, the patent is assigned as an original to the class which provides for the "lowest" lettered category and is cross-referenced to such other classes as required by the claims and disclosure.

When a patent has a claim to subject matter in categories B or C of the above list, which subject matter is provided for in this class, and other claim to subject matter in this same category which is provided for in another class, the patent is placed as an original in the other class and cross-referenced to this class. For example, when one claim is to a solid resinous hydrocarbon polymer and another is to a liquid hydrocarbon polymer, the patent is classified as an original in the class which provides for the solid resinous polymer.

The rules for determining Class placement of the Original Reference (OR) for claimed chemical compositions are set forth in the Class Definition of Class 252 in the section LINES WITH OTHER CLASSES AND WITHIN THIS CLASS, subsection Composition Class

Superiority, which includes a hierarchical Order of Superiority for Composition Classes.

For a compilation of Patent Office classes dealing with categories B and C above, see the definition of subclass 1 below. For a compilation of Patent Office classes dealing with category E above, see the definition of subclass 800 below.

As for category D, a process for manufacturing a composition or a chemical compound generally is provided for in the class which would provide for the composition or compound, per se, were it to be claimed. An exception to this rule is where another class provides for a particular synthesis procedure. The main classes of this type are the following, in order of priority:

Class 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for processes for growing therein-defined single-crystal of all types of materials, including hydrocarbon.

Class 201, Distillation: Processes, Thermolytic, provides for the synthesis of chemical compounds or elements, including hydrocarbons, by elevated-temperature processes which leave a solid carbonaceous char, e.g., coke.

Class 204, Chemistry: Electrical and Wave Energy, for synthesis of chemical compounds or elements, including hydrocarbons, by electrical or wave energy, as provided for under the Class 204 definition.

Class 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, for electrolytic processes, including synthesis of chemical compounds or elements.

Class 435, Chemistry: Molecular Biology and Microbiology, provides for the synthesis of chemical compounds or elements, including hydrocarbons, by enzymatic action.

Class 518, Chemistry: Fischer-Tropsch Processes; or Purification, or Recovery of Products Thereof, provides for the synthesis of chemical compounds, including hydrocarbons, by the hydrogenation of carbon oxides.

If a synthesis process leads to two products, a hydrocarbon and a nonhydrocarbon, both of which are intended to be recovered from the process, the patent is classified as an original in the class providing for the nonhydrocarbon synthesis and cross-referenced to Class 585 when the hydrocarbon synthesis is proper for this class. For example, a process which treats an alkyl sulfate to recover both an olefin and sulfuric acid is placed in the class providing for sulfuric acid recovery.

Where a patent contains a claim to a multistep synthesis process for producing a nonhydrocarbon intermediate which is converted to a hydrocarbon and has another claim for synthesis only of the nonhydrocarbon intermediate, the patent is classified as an original in the class providing for synthesis of the intermediate, despite the fact that the claim for Class 585 is more “comprehensive”.

When a patent has claims only to a multistep process which produces a hydrocarbon compound or mixture which would be classified in this class, and the final synthesis step is provided for in Classes 195, 201, or 204, the patent is classified in that class; where the step provided for in those classes is earlier than the final synthesis step, the patent is classified in Class 585.

Where a Class 201 synthesis step is not positively recited, that is, synthesis is performed upon mere hydrocarbon products of such step, classification is proper in Class 208 when a hydrocarbon mixture is obtained and in Class 585 when a relatively pure hydrocarbon compound is obtained.

Where a patent has only category E claims, the above rules do not necessarily apply. The complex classification lines which prevail among the purification classes are spelled out below, in the discussion of the hierarchical relationship among subclasses 800+ of this class and other areas.

LINE BETWEEN SUBCLASSES 800+ AND OTHER AREAS

Subclasses 800+ are residual and receive only those original patents not acceptable elsewhere. These “elsewheres” are dealt with in the Notes below, and are summarized as follows

(A) Separation or purification by electrical and or wave energy phenomena. - Class 204, Chemistry:Electrical Wave Energy. See (1) Note below.

(B) To produce mineral oil mixture - Class 208, Mineral Oils: Processes and Products. See (2) Note below.

(C) Involving the formation of an adduct of urea or thioreaor thiorea - Class 260, Chemistry of Carbon Compounds, subclass 96.5. See (3) Note below.

(D) Involving the formation of a hydrocarbon hydrate - Class 585, Chemistry of Hydrocarbon Compounds, subclass 15. See (4) Note below.

(E) Involving hydrogenation of an unsaturated bond of a hydrocarbon - Class 585, Chemistry of Hydrocarbon Compounds, subclasses 250+. See (5) Note below.

(F) Of gaseous feed - Class 95, Gas Separation: Processes. See (6) Note below.

. (G) Involving a chemical reaction - Class 423, Chemistry of Inorganic Compounds. See (7) Note below.

. (H) Involving liquefaction or solidification. Class 62, Refrigeration. See (8) Note below.

(I) Of liquid feed - Class 210, Liquid Purification or Separation. See (9) and (10) Note below

. (J) By distillation - Class 203, Distillation: Processes, Separatory. See (11) Note below.

. (K) By removal of gas or vapor - Class 95, Gas Separation: Processes.. See (12) Note below.

. . (L) To leave solids concentrate - Class 159, Concentrating Evaporators. See (13) Note below.

. (M) By chilling to solidify - Class 62, Refrigeration. See Note 14 below.

(N) By drying a solid - Class 34, Drying and Gas or Vapor Contact With Solids. See Note 15 below.

(1) Note. Where the purification process involves a chemical reaction due to electrical or wave energy (other than merely thermal) effects, or movement of ions or particles due to electrical "pressure" (electrophoresis or electroosmosis) classification in Class 204 is usually proper.

(2) Note. Where the desired product is a mixture of hydrocarbons which can be considered a mineral oil fraction, classification is proper in Class 208, subclasses 177+ and 308+.

(3) Note. Where the process involves the formation of an adduct of urea or thiourea classification in Class 260, subclass 96.5 is proper.

(4) Note. Where the process involves the formation of a hydrocarbon hydrate (complex of hydrocarbon with water) classification is proper in this class (585), subclass 15.

(5) Note. Where the process involves conversion of impurity in a desired hydrocarbon to more of the desired hydrocarbon, classification is proper in a synthesis subclass of this class (585). See, in particular, subclasses 258+.

(6) Note. Where the feedstock is specified as being in gaseous form and the recovery process involves a chemical reaction, classification in Class 423, subclasses 210+ is usually proper.

(7) Note. Where the feedstock is specified as being in gaseous form and the recovery process involves a chemical reaction, classification in Class 423, subclasses 210+ is usually proper.

(8) Note. Where the feedstock is a normally gaseous material (e.g., a C_1-C_4 hydrocarbon) and separation is accomplished by removing heat, thereby liquefying or solidifying a component of the feed mixture, classification is proper in Class 62, subclasses 606+ and 617+.

(9) Note. Where the feedstock is specified as being in gaseous form and the recovery process does not meet the limitations of (11) Note or (12) Note above, classification in Class 95 is usually proper.

(10) Note. Where the feedstock is a liquid mixture and separation is accomplished by vaporizing and condensing a component of the mixture, classification in Class 203 is usually proper. Such classification is also proper when a chemical reaction which facilitates distillation takes place before the distillation and/or a disparate separation procedure, not involving a chemical reaction, follows the distillation. Classification in Class 203 also is usually proper when an additional agent is added to dissolve a desired or undesired component, adjust the boiling point of the mixture, etc., (extractive distillation). See also the note in the

class definition of this class (585) to Class 201, Distillation: Processes, Thermolytic.

(11) Note. Where the feedstock is a liquid mixture and a component is removed as a gas without subsequent condensation, classification is usually proper in Class 95, subclasses 241+.

(12) Note. Where the feedstock is a liquid solution or a suspension of solids in a liquid and the separatory process is the evaporation of a component, without subsequent condensation of vapor, to leave a fluent concentration of solids or a dry solid, classification in Class 159 is usually proper.

(13) Note. Where the feedstock is a liquid mixture and separation is accomplished by chilling to solidify (crystallize) a component of the mixture, classification is as follows:

(a)Where no non-hydrocarbon organic compounds are disclosed and a hydrocarbon compound is separated or purified or a hydrocarbon hydrate is formed, placement is proper in Class 585, especially subclasses 812+.

(b)Placement is to Class 260, including the related classes, for processes of treating or modifying claimed or disclosed non-hydrocarbon organic compounds: by crystallization wherein the crystallization is not brought about by refrigeration; or wherein crystallization, by any means including refrigeration, is combined with synthesis or modification of carbon compounds by chemical means; or wherein separation of carbon compounds is by physical means other than refrigeration. Otherwise placement is proper in Class 62 when refrigeration is claimed.

(c)Placement is to Class 62 where no specific (i.e., classifiable) compound is disclosed.

(d)Placement is proper for Class 117 for processes forming single-crystals of all types of materials, including inorganic or organic, and by all techniques. See the Class 117 definitions for guidance in placement of single-crystal art.

(14) Note. Where the separation of a liquid feed is by flocculation, filtration, gravity settling, or magnetic attraction of solids already present in the feed, classification in Class 210 is usually proper.

(15) Note. Where separation of liquid feed is by phenomenon other than those recited in notes 14-18, classification in Class 210 is usually proper when (a) water is claimed as the product or a species of product to be recovered or (b) no species of product is claimed and water is disclosed as a recoverable species.

(16) Note. Where the feed is a solid or slurry of solid and liquid is evaporated from the feed, classification in Class 34 is usually proper. If the starting material is in the form of a liquid suspension or solution, even if the process is continued to the point of complete dryness, Class 159 will take the process. The removal of water of crystallization is considered a chemical synthesis for this class (585).

LINE WITH CLASS 208

The subject matter of Class 208, Mineral Oils: Processes and Products, is closely related to the subject matter of this class and constitutes a subset restricted as to product, feedstocks to the processes, and materials recovered from the process.

Class 208 provides for the treatment of generally liquid (oil) feedstocks which have come out of the ground (mineral) or liquid feedstocks of nonmineral origin which cannot be readily distinguished from mineral feedstocks. The treatment given such feedstocks must result in a mixture of compounds if it is to be classified in Class 208 as a product or a process. Reaction of a Class 208 material with small amounts of nonmineral oil hydrocarbons will not take a process out of Class 208, but a claim to a product mixture of mineral oil and nonmineral oil material usually will serve to assign such product to Class 585. Conversion of a Class 208 feedstock to a nonhydrocarbon intermediate and subsequent conversion back to a hydrocarbon mixture is provided for in Class 585. Conversion of a mineral

oil feedstock to normally gaseous hydrocarbons (C_4 or less) and reconversion of such gases back to a liquid hydrocarbon compound or mixture is provided for in Class 585.

Besides those hydrocarbon mixtures which have been recovered from the earth as a liquid, i.e., petroleum, other feedstocks which qualify a process for placement in Class 208 are those mainly hydrocarbon feedstocks derived from solid natural products, e.g., coal, wood, asphalt, etc., and "Fischer-Tropsch" crudes, that is, those derived from the Fischer-Tropsch synthesis which is the subject matter of Class 518, subclass 700.

The scope of the purification and separation treatments included in Class 208 differs from those included in Class 583, mainly in that Class 208 takes its own distillation processes.

SUBCLASSES

1 PRODUCT BLEND, E.G., COMPOSITION, ETC., OR BLENDING PROCESS, PER SE:

This subclass is indented under the class definition. Subject matter which comprises an intentional mixture of a hydrocarbon with another material which may be a hydrocarbon or a non-hydrocarbon, and process for making such a mixture which does not involve any claimed chemical reaction or purification step.

(1) Note. By "intentional" it is meant that at least one of the different components of the mixture is present because of a desired effect, not merely because the mixture is the normal result of a synthesis process, as in polymerization, or is found as such in nature. Reaction product mixtures, per se, are classified in subclasses 16+.

(2) Note. The rules for determining Class placement of the Original Reference (OR) for claimed chemical compositions are set forth in the Class Definition of Class 252 in the section LINES WITH OTHER CLASSES AND WITHIN THIS CLASS, subsection COMPOSITION CLASS SUPERIORITY, which includes a hierarchical ORDER OF SUPERIORITY FOR COMPOSITION CLASSES. Where classification is called for in different main classes, based upon the components of the composition or claims pertaining to a plurality of use, properties, or functions, a patent is assigned as an original to that class or portion of a class coming first in the list given in the class definition, (5) Note of Class 252. This superiority list is not intended as a complete list and will be expanded or added to as the relationship between other classes containing compositions is determined.

The enumeration of classes below, in general, follows the priority list of Class 252 and covers some additional classes. Thus, this enumeration is not authoritative insofar as priority of classes is concerned. The definitions of these classes should be studied to determine the proper placement of patents therein.

Class 504, Plant Protecting and Regulating Compositions, subclasses 116.1 through 367 provide for plant growth regulating compositions; and subclasses 101+ provide for a fertilizer containing an insecticide, fungicide, or deodorant.

Class 424 provides for drug, bio-affecting and body treating compositions. A material, composition, or compound containing a Class 424 composition to preserve the material, composition, or compound itself from biological attack generally is classified with the material, composition, or compound. Residual methods for preserving, disinfecting, or sterilizing are in Class 422.

Class 426 provides for foods, beverages, and other edible compositions and certain edible articles and stock materials.

Class 71, provides for fertilizers.

Class 208, subclasses 14+ provide for composition made up exclusively of components derived from mineral oil (petroleum) and certain other feedstocks, as explained in the class definition of

Class 208. Each such component may be an entire "crude oil", a complex distillate or fraction thereof, a fraction formed by some chemical conversion (e.g., cracking, reforming), solvent extraction, or other treatment provided for in Class 208. Where, in addition to one or more mineral oil-derived components, the composition contains a single definite hydrocarbon or a mixture of hydrocarbons not of mineral origin, the composition is classified in this class (585). Exemplary of such compositions for this class are gasoline admixed with benzol, hydrocarbons formed by reduction of the alcohol and aldehyde fraction produced by the hydrogenation of carbon monoxide, naphthalene, isopentane, alkylated benzene, disobutylene, anthracene, etc. A process of separating the mineral oil into fractions, one of which may be definite hydrocarbon, followed by treating the various fractions to convert them chemically and then blending two or more fractions to form the final fuel is classified in Class 208, Mineral Oils: Processes and Products, unless there is present a claim to the composition, per se, which recites the blend of a mineral oil and a definite hydrocarbon.

Class 149 provides for explosive and thermic compositions and charges. Subclass 87 provides for such compositions containing free metal or metal hydride with a hydrocarbon.

Class 508, particularly subclasses 110+, provides for lubricants which contain nonhydrocarbons. Lubricants which are mixtures of hydrocarbons (except for solid synthetic hydrocarbon polymers) are in this Class 585 or in Class 208. Lubricants which contain solid synthetic hydrocarbon polymers are classified in Class 508.

Classes 44 and 48 provide for fuels which contain nonhydrocarbon components. Fuels which are all hydrocarbon are in this class (585) or in Class 208.

Class 148 provides in subclasses 240+ and 22+ for certain compositions for treating solid metal. Subclass 25 provides for oleaginous fluxing compositions.

Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+ for sintered metal powder compositions and subclasses 95 and 257 for certain additives for molten metal.

Class 430, Radiation Imagery Chemistry: Process, Composition, or Product, Thereof for compositions and articles defined in terms of their chemical composition which are useful in forming images by the impingement of radiation thereon, e.g., photography, etc.

Class 252 provides in subclasses other than those listed above or below for special utility compositions.

Class 106 provides for a composition which is in fluent or solid noncoherent form and which is adapted for coating or impregnating and for change to a less fluent or a solid coherent form by setting (e.g., concrete, plaster, etc.), chemical reaction, removal of solvent, solidification from molten state, etc., and fillers and pigments for its own and some other compositions. Subclass 11 provides for a hydrocarbon-containing polish; subclass 239 provides for a coating or plastic composition containing a fatty oil and a hydrocarbon; and subclass 285 for such composition containing a hydrocarbon.

Class 51 provides for abrading compositions.

Classes 520+ provide for a synthetic resin (spinnable, film forming, etc.) and Class 260, subclasses 709+ provide for a vulcanizable natural hydrocarbon gum (e.g., rubber).

2Class 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Break-

ing, or Inhibiting, appropriate subclasses for subject matter relating to: colloid systems (such as sols*, emulsions, dispersions, foams, aerosols, smokes, gels, or pastes) or wetting agents (such as leveling, penetrating, or spreading); subcombination compositions of colloid systems containing at least an agent specialized and designed for or peculiar to use in making or stabilizing colloid systems; compositions and subcombination compositions specialized and designed for or peculiar to use in breaking (resolving) or inhibiting colloid systems; processes of making the compositions or systems of the class; processes of breaking (resolving) or inhibiting colloid systems; in each instance, when generically claimed or when there is hierarchically superior provision in the USPC for the specifically claimed art.
Class 252, subclasses 299.01+, 363.5, 367.1, 372+, and 378 provide for compositions on a nonfunctional basis.

Class 423 provides for inorganic compounds; and subclasses 265+ provide for compositions having an inorganic compound and an agent which improves the general utility of the compound.

Class 260 and its daughter Classes 530-570 provide for an organic compound containing more than carbon and hydrogen and such compound blended with an agent which improves the general utility of the compound.

SEE OR SEARCH THIS CLASS, SUBCLASS:
302+, for a process in which different hydrocarbon components of a composition are separately synthesized and then blended.

2 With nonhydrocarbon additive:
This subclass is indented under subclass 1. Subject matter containing a hydrocarbon and a nonhydrocarbon.

(1) Note. This subclass includes, for example, polymerizable hydrocarbons, e.g., styrene, butadiene, etc., admixed with a stabilizing or preserving agent.

(2) Note. In the compositions of this and indented subclasses, the nonhydrocarbon is added to improve the general utility of the hydrocarbon, e.g., by preserving it, etc. Where the nonhydrocarbon additive improves a utility of the hydrocarbon which is provided for elsewhere, the patent is classified elsewhere; for example, where the additive improves the dielectric properties, it is in Class 252, subclasses 570+, etc.

SEE OR SEARCH CLASS:
252, Compositions, subclasses 380+, particularly subclasses 397+, for preserving agents, per se.
423, Chemistry of Inorganic Compounds, for a compound of that class mixed with a preserving agent, etc.

3 O containing:
This subclass is indented under subclass 2. Subject matter wherein a nonhydrocarbon additive contains oxygen.

4 And N containing:
This subclass is indented under subclass 3. Subject matter wherein a nonhydrocarbon additive contains nitrogen.

(1) Note. The oxygen and nitrogen may be present in the same additive molecule or in different additive molecules.

5 Additive(s) aromatic:
This subclass is indented under subclass 4. Subject matter wherein the nitrogen and/or oxygen are present in a compound containing an aromatic moiety.

6 Gaseous blend:
This subclass is indented under subclass 1. Subject matter wherein the mixture is a gas at standard temperature and pressure.

SEE OR SEARCH CLASS:
48, Gas: Heating and Illuminating, appropriate subclasses for such compositions containing other than merely hydrocarbons.

252, Compositions, for gaseous compositions containing other than merely hydrocarbons, especially subclass 182.11 for chemically reactive gas compositions; subclasses 372+ for gas compositions in general; and subclass 571 for gaseous dielectric compositions.

6.3 Fluent dielectric:
This subclass is indented under subclass 1. Subject matter claimed as a nonconductor of electricity.

SEE OR SEARCH CLASS:
252, Compositions, subclasses 570+ for a fluent dielectric composition containing other than hydrocarbons, and the definitions thereto, for the location of other electric insulating compositions.

6.6 Mineral oil-containing:
This subclass is indented under subclass 6.3. Subject matter wherein the dielectric composition includes a mineral oil (petroleum) fraction.

7 Component of indefinite molecular weight greater than 150:
This subclass is indented under subclass 1. Subject matter containing a component which (a) is not describable by an empirical formula free of numeric ranges and (b) has a molecular weight greater than 150.

(1) Note. Where the component is normally solid or is a heavy, oily material, it is assumed to have a molecular weight greater than 150.

SEE OR SEARCH CLASS:
252, Compositions, subclasses 67+, 70+, and 71+ for "functional fluids", that is, hydraulic transmission fluids, low freezing point fluids, etc., containing other than merely hydrocarbons.
508, Solid Antifriction Devices, Materials Therefor, Lubricant and Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, particularly subclasses 110+, for lubricant compositions which contain a nonhydrocarbon component or a solid synthetic hydrocarbon polymer component.

8 Reaction product of halogenated hydrocarbons:
This subclass is indented under subclass 7. Subject matter in which the component of indefinite high molecular weight is one produced from a compound containing only carbon, hydrogen, and halogen by a reaction wherein halogen is removed or presumed to be removed.

9 Wax:
This subclass is indented under subclass 7. Subject matter in which the component is described as wax.

(1) Note. See the definition of Class 208, subclass 20 for a description of "wax".

(2) Note. The component may be a synthetically produced polymer which is described as "waxy".

SEE OR SEARCH THIS CLASS, SUBCLASS:
946, for a collection of patents concerned with the production of waxy or grease-like polymers.

10 Polymer:
This subclass is indented under subclass 7. Subject matter in which the component is a product made by the condensation of an indefinite number of the same or different hydrocarbon molecules to form a single molecule.

11 Containing aromatic ring:
This subclass is indented under subclass 10. Subject matter in which the polymer has an aromatic ring as a substituent or as part of the polymer chain.

12 Plural polymers or copolymer of specified olefins:
This subclass is indented under subclass 10. Subject matter wherein the composition contains two or more different polymers or contains a polymer made by joint polymerization of two or more different, identified olefins.

(1) Note. A patent is not placed in this subclass on the mere basis that the polymer is one made from olefins within a

defined range of molecular weight, e.g., "a polymer of C_{3-5} olefins", etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

11, for a blend containing a copolymer derived from an acyclic olefin and an olefin having an aromatic substituent, e.g., ethylene and stilbene, etc.

13 Mineral oil (petroleum) fraction:

This subclass is indented under subclass 7. Subject matter wherein the component is a mineral oil fraction.

14 For fuel use only:

This subclass is indented under subclass 1. Subject matter designed for use exclusively as a fuel.

SEE OR SEARCH THIS CLASS, SUBCLASS:

6, for a hydrocarbon fuel mixture which is a gas.

SEE OR SEARCH CLASS:

44, Fuel and Related Compositions, appropriate subclasses for a liquid or solid fuel composition containing more than merely hydrocarbons.

149, Explosive or Thermic Compositions or Charges, appropriate subclasses for such materials containing hydrocarbon and an oxidant.

15 HYDRATE OR PRODUCTION THEREOF:

This subclass is indented under the class definition. Subject matter in which a product molecule contains hydrocarbon and water in a definite molecular weight ratio representable by a chemical formula, or in which a process makes such a compound.

(1) Note. The process may have as its ultimate utility the purification of a hydrocarbon, and the hydrate produced may be decomposed to hydrocarbon and water.

16 COMPOUND OR REACTION PRODUCT MIXTURE:

This subclass is indented under the class definition. A product which may be a single identifiable compound in a relatively pure state or may be a mixture of closely related compounds which results from a synthesis process.

(1) Note. Only patents which claim a hydrocarbon product are placed in this and its indented subclasses. Where a process for synthesis and/or purification of the product is also claimed, the patent is cross-referenced to the appropriate subclass(es) below.

(2) Note. This subclass (16) is the locus for acyclic nonpolymer hydrocarbon products.

SEE OR SEARCH CLASS:

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 312-321 for the chemical destruction of hydrocarbon hazardous or toxic waste.

17 Polymer of indefinite molecular weight:

This subclass is indented under subclass 16. Subject matter wherein the product is a molecule or mixture of molecules which cannot be defined by an empirical formula in which all numerical values are invariable, and which has been formed by the union of smaller entire hydrocarbon molecules (addition polymerization) or the hydrocarbyl moieties of nonhydrocarbon molecules (condensation polymerization).

(1) Note. The smaller (monomer) molecules may be all alike or two or more varieties may make up portions of the final product molecule.

(2) Note. Polymers included herein generally are waxy or liquids or can have a molecular weight less than is required for placement in Classes 520+. While "solid polymer" implies that a product is a resin for Classes 520+, the designation of the product as a "wax" makes it suitable for this class (585).

SEE OR SEARCH THIS CLASS, SUBCLASS:

945, and 946, for collections of patents drawn to processes of making drying oil polymers and waxy or grease-like polymers, respectively.

SEE OR SEARCH CLASS:
520, Synthetic Resins or Natural Rubbers, for hydrocarbon polymers claimed or disclosed as a synthetic resin solid.

18 Acyclic:
This subclass is indented under subclass 17. Subject matter in which the polymer has no ring in its structure.

19 Containing aromatic ring:
This subclass is indented under subclass 17. Subject matter in which the polymer contains an aromatic ring.

20 Alicyclic:
This subclass is indented under subclass 16. Subject matter containing a carbocyclic ring but free of any resonating bond system characteristic of benzene or azulene.

21 Polycyclo, i.e., fused:
This subclass is indented under subclass 20. Subject matter which contains at least two rings which share two carbon atoms.

22 Of differing carbon content, more than three or with bridge:
This subclass is indented under subclass 21. Subject matter containing at least four rings, each of which shares two adjacent carbon atoms with another ring, or two rings fused where at least one ring contains a different number of carbons from the others, or the ring system contains a bridge, that is, a carbocyclic ring which shares with another ring two carbons not adjacent to each other.

SEE OR SEARCH CLASS:
552, Organic Compounds, subclass 653 for Vitamin D compounds, cholecalciferols, dihydrotachysterols, 3-5 cyclovitamin D compounds, etc. which contain only carbon and hydrogen.

23 Unsaturated ring:
This subclass is indented under subclass 20. Subject matter containing a ring which has olefinic unsaturation.

24 Aromatic:
This subclass is indented under subclass 16. Subject matter having at least one carbocyclic ring, usually six-membered, which is resonating or is characterized by three conjugated double bonds.

(1) Note. Azulene (Fig. 1) is considered to be aromatic.

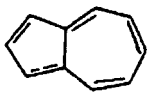


FIGURE 1. Azulene

(2) Note. Naphthalene (Fig. 1), dihydronaphthalene (Fig. 2), and tetrahydronaphthalene (Tetralin) (Fig. 3), are aromatic, but decahydronaphthalene (Decalin) (Fig. 4) is alicyclic.

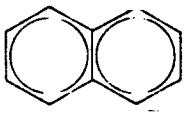


FIGURE 1. Naphthalene

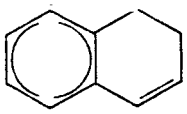


FIGURE 2. dihydronaphthalene

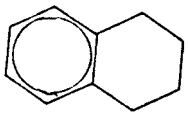


FIGURE 3. tetrahydronaphthalene (Tetralin)

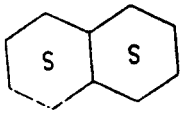


FIGURE 4. decahydronaphthalene (Decalin)

SEE OR SEARCH THIS CLASS, SUBCLASS:

319+, for a synthesis process involving serial diverse conversions leading to production of a recoverable aromatic compound.

400+, for synthesis of an aromatic compound.

804+, for a process for purifying an aromatic compound by plural diverse serial separations.

827+, and 831, for a purification process in which an aromatic compound is sorbed by a solid sorbent.

25 Plural rings:
This subclass is indented under subclass 24. Subject matter containing at least two rings, where at least one ring is an aromatic moiety.

26 Polycyclo, i.e., fused:
This subclass is indented under subclass 25. Subject matter where at least two of the rings share two adjacent carbon atoms.

27 Of differing carbon content or with bridge:
This subclass is indented under subclass 26. Subject matter having a bond or an atom or an acyclic carbon atom chain connecting two nonadjacent ring atoms, or where at least one ring is not a six-membered ring, e.g., fluorene.

240 PRODUCTION OF HYDROCARBON MIXTURE FROM REFUSE OR VEGETATION:
This subclass is indented under the class definition. Subject matter in which the starting (feed) material of the process is plant material in a chemically unaltered form or is a material which ordinarily would be discarded as of no value, e.g., municipal waste, refinery sludge, etc., is treated to recover therefrom a mixture of hydrocarbons, e.g., a fuel "oil" fraction, etc.

SEE OR SEARCH CLASS:

201, Distillation: Processes Thermolytic, appropriate subclasses for a similar process which produces also a carbon char product.

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 312-321 for the chemical destruction of hydrocarbon hazardous or toxic waste.

241 From synthetic resin or rubber:
This subclass is indented under subclass 240. Subject matter where the starting waste material is a synthetic resin or rubber.

242 From wood:
This subclass is indented under subclass 240. Subject matter in which a claimed feedstock to the process is the stem of a tree sawdust or a similar vegetation material.

SEE OR SEARCH CLASS:

428, Stock Material and Miscellaneous Articles, subclass 2 for a compacted trash or refuse bundle.

250 ADDING HYDROGEN TO UNSATURATED BOND OF HYDROCARBON, I.E., HYDROGENATION:
This subclass is indented under the class definition. Subject matter where elemental hydrogen is included or produced in a reaction and the hydrogen causes an unsaturated bond of a hydrocarbon to become less unsaturated.

(1) Note. The starting unsaturated bond may be olefinic, acetylenic, or aromatic.

(2) Note. Hydrogen exchange disproportionation is included herein where the more saturated hydrocarbon product is a desired product of the process. See subclass 257.

(3) Note. Since a process classified herein requires the unsaturated bond of a feedstock to become more saturated, the synthesis of a one carbon atom product, e.g., methane or a methylene free radical, is not proper for classification herein.

251 With subsequent diverse conversion:
This subclass is indented under subclass 250. Subject matter in which a synthesis operation, different from hydrogenation of an unsaturated bond is performed upon the hydrogenated feedstock.

(1) Note. The subsequent conversion must be more than the mere treatment of an unwanted by-product to make such by-

product equivalent to the feedstock to the original hydrogenation.

252 Dehydrogenation:
This subclass is indented under subclass 251. Subject matter wherein the reaction after the hydrogenation is the removal of hydrogen, i.e., dehydrogenation.

253 Isomerization:
This subclass is indented under subclass 251. Subject matter wherein the hydrogenated feedstock is treated to change its molecular configuration without a change in its molecular weight.

SEE OR SEARCH THIS CLASS, SUBCLASS:
371+, for isomerization by ring expansion or contraction to produce an alicyclic hydrocarbon.

254 With preliminary diverse conversion:
This subclass is indented under subclass 250. Subject matter in which the feedstock to hydrogenation is the product of a synthesis operation, different from hydrogenation of unsaturation bonds.

255 Polymerization of olefins only:
This subclass is indented under subclass 254. Subject matter wherein the only other synthesis step is the polymerization of an olefinic feedstock before hydrogenation reaction.

256 Molecular weight reduction:
This subclass is indented under subclass 254. Subject matter wherein, prior to hydrogenation, the feedstock is treated to remove hydrogen and/or carbon from some or all of its molecules.

257 By hydrogen transfer from other hydrocarbon:
This subclass is indented under subclass 250. Subject matter wherein the hydrogen which goes toward saturation of the unsaturated bonds is introduced to the process as a hydrocarbon compound, the latter hydrocarbon compound becoming less saturated.

(1) Note. Where the less saturated hydrocarbon is the only desired product of the process, the process is classified below as a dehydrogenation reaction.

(2) Note. Processes according to this subclass are sometimes called disproportionation", "hydrogen-exchange disproportionation", or "hydrogen transfer".

258 Hydrocarbon is contaminant in desired hydrocarbon:
This subclass is indented under subclass 250. Subject matter where the unsaturated hydrocarbon which is hydrogenated is an impurity or contaminant in a desired hydrocarbon, a substantial amount of which desired hydrocarbon is present in the feedstock to the process.

(1) Note. The hydrogenation may result in the production of further amounts of the desired product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
800+, and the notes to the main line subclass for an explanation of "contaminant" and the line between this class (585) and the purification classes.

259 Hydrogenation of diolefin or triple bond:
This subclass is indented under subclass 258. Subject matter wherein the contaminant has a triple bond which is hydrogenated or has two double bonds, one or both of which is hydrogenated.

(1) Note. Examples of subject matter contained herein are the conversion of acetylene impurity contained in ethylene to more ethylene, conversion of butadiene impurity to butene or butane, etc.

260 Using catalyst or support of defined structure, surface areas, or pore size:
This subclass is indented under subclass 259. Subject matter where the hydrogenation of a bond in a contaminant takes place in the presence of a catalyst or support of specific structure, e.g., gamma-alumina, or of a specific surface area or pore size, e.g., 3 meters per cubic meter, 5-7 angstroms, etc.

(1) Note. The description of a hydrogenation catalyst as a "molecular sieve" is sufficient for placement in this subclass.

261 Using catalyst and additional nonmetal material:
This subclass is indented under subclass 259. Subject matter where the contaminant is hydrogenated in the presence of a catalyst and at least one additional nonmetal material, e.g., Decalin, etc.

262 Using S or Group I or II transition metal-containing catalyst:
This subclass is indented under subclass 259. Subject matter employing a catalyst which contains sulfur, copper, silver, gold, zinc, cadmium, or mercury.

263 With temperature or concentration gradient in reactor or specified provision for heating, cooling, or reactor control:
This subclass is indented under subclass 250. Subject matter wherein the temperature or concentration of reactants or composition of a catalyst changes gradually from one point to another in a hydrogenation reactor, wherein procedures for heating or cooling the reactor, reactants, catalyst, etc., are specified, wherein a test or measurement is made, or wherein a synthesis condition is varied in response to a change in a diverse condition.

264 With preliminary treatment of feed or plural separation procedures:
This subclass is indented under subclass 250. Subject matter wherein a reactant to the process is treated, e.g., by heating, purification, etc., before the hydrogenation reaction or wherein more than one separation procedure is applied to the hydrogenerator effluent.

265 Plural hydrogenation stages:
This subclass is indented under subclass 250. Subject matter wherein an effluent material from a hydrogenation reaction is hydrogenated, e.g., passage of the feed through a stage having a certain catalyst activity, and a subsequent state having a different activity, etc.

266 Hydrocarbon is aromatic:
This subclass is indented under subclass 250. Subject matter which is directed to the hydrogenation of aromatic compounds, e.g., the hydrogenation of benzene to cyclohexane or cyclohexene, or of naphthalene to form 1,2,3,4-tetrahydronaphthalene and/or dechydronaphthalene.

SEE OR SEARCH THIS CLASS, SUBCLASS:
940, for a hydrogenation or other process which results in the opening of a hydrocarbon ring.

267 Using alkaline metal material:
This subclass is indented under subclass 266. Subject matter wherein the hydrogenation takes place in the presence of lithium, sodium, potassium, rubidium, cesium, beryllium, magnesium, calcium, strontium or barium in free or combined form.

268 To produce polycyclic:
This subclass is indented under subclass 266. Subject matter wherein the product material has more than one ring in its molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:
360+, for a process in general for synthesizing polycyclic material having no aromatic ring.
400+, especially subclasses 406, 410+, 422+, and 431 for synthesis of polycyclic materials in which at least one ring is aromatic.

269 Using Group VIII metal-containing catalyst with additional nonhydrocarbon agent:
This subclass is indented under subclass 266. Subject matter wherein the reaction mixture contains a nonhydrocarbon agent and cobalt, iridium, iron, nickel, osmium, palladium, platinum, rhodium, or ruthenium in free or combined form.

270 Co, Fe, or Ni:
This subclass is indented under subclass 269. Subject matter wherein the Group VIII metal is cobalt, nickel, or iron.

271 Partial:
This subclass is indented under subclass 250. Subject matter wherein only part of the unsaturation in a hydrocarbon feed molecule is hydrogenated resulting in an unsaturated product, such as the conversion of butadiene to butene or acetylene to ethylene.

272 Hydrogen supplied by water or alcohol:
This subclass is indented under subclass 271. Subject matter wherein the hydrogen for the hydrogenation is supplied by the removal of hydrogen from water or organic hydroxy molecules.

273 Using Group VIII metal-containing catalyst:
This subclass is indented under subclass 271. Subject matter wherein the reaction is catalyzed by iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium or platinum in free or combined form.

274 Co, Fe, or Ni:
This subclass is indented under subclass 273. Subject matter wherein the catalyst contains iron, cobalt, or nickel.

275 Using transition metal-containing catalyst:
This subclass is indented under subclass 250. Subject matter wherein the reaction takes place in the presence of a catalyst containing a transition metal in free or combined form.

(1) Note. The transition metals are elements in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table they include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

276 Elemental Co, Fe, or Ni:
This subclass is indented under subclass 275. Subject matter wherein the hydrogenation catalyst is iron, cobalt, or nickel in the free or uncombined (zero-valence) state.

277 Group VIII metal with additional nonhydrocarbon agent or complexed with hydrocarbon:
This subclass is indented under subclass 275. Subject matter wherein the hydrogenation catalyst contains cobalt, iridium, iron, nickel, osmium, palladium, platinum, rhodium, or ruthenium in free or combined form, and contains an additional nonhydrocarbon agent, e.g., a support etc., or the catalyst is complexed with a hydrocarbon.

300 PLURAL PARALLEL SYNTHESES:
This subclass is indented under the class definition. Subject matter involving more than one reaction, in which the feedstock to and effluent from one reaction is independent of the feedstock to and effluent from the other reaction.

(1) Note. The feedstocks may have a common source and the effluents may be subsequently blended, but the feedstock to one reaction is not all or part of the effluent from the other reaction.

(2) Note. Excluded from the terms "feedstock" and "effluent" as used in the definition are extraneous materials such as catalyst, solvents, diluents, etc., which do not make a net contribution of carbon or hydrogen to the final product(s).

SEE OR SEARCH THIS CLASS, SUBCLASS:
265, for plural parallel synthesis each of which involves adding hydrogen to an unsaturated bond of a hydrocarbon.
310+, for a process where the effluent of a synthesis is used as feedstock to a diverse synthesis.

301 Using same catalyst, solvent, inert heat carrier, or component thereof:
This subclass is indented under subclass 300. Subject matter wherein a catalyst, solvent, diluent or inert heat carrier, or a material which makes up a part of such substance is used in one of the parallel syntheses, its use in such synthesis is discontinued, and the catalyst etc., or component thereof is used in the other parallel synthesis.

(1) Note. Use of identical extraneous materials in both parallel syntheses is not sufficient for placement of a patent in this subclass.

(2) Note. Where both parallel syntheses use an extraneous agent drawn from and returned to a common pool or reservoir, the patent is placed here.

302 With blending of products from two parallel reactions:

This subclass is indented under subclass 300. Subject matter in which a reaction product from one of the parallel syntheses is blended with a reaction product from another of the parallel syntheses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

1+, for a process of blending which does not include a claimed synthesis.

955, for a defined mixing procedure, usually in conjunction with a hydrocarbon synthesis.

303 And passage to further reaction:

This subclass is indented under subclass 302. Subject matter wherein the blended product stream is passed to another reaction.

(1) Note. Where the subsequent synthesis is of a type diverse from at least one of the prior parallel syntheses, the patent should be crossed to the appropriate subclass of subclasses 310+. See the definition of subclass 310 for the meaning of "diverse".

(2) Note. Mere recycle of a portion of the blend is not sufficient for placement in this subclass.

(3) Note. The blending may take place in the zone of subsequent reaction.

304 Diverse parallel syntheses:

This subclass is indented under subclass 300. Subject matter wherein the syntheses conducted in parallel produce different types of product or are different types of reaction.

(1) Note. For a fuller explanation of "diverse" see the definition of subclass 310, (1) Note below.

310 PLURAL SERIAL DIVERSE SYNTHESES:

This subclass is indented under the class definition. Subject matter in which a feedstock is subjected to chemical conversion to form an intermediate and in a separate subsequent step the intermediate is converted to a desired hydrocarbon product or to another intermediate, etc., each conversion involving a diverse synthesis type.

(1) Note. A series of syntheses is considered to be diverse when either (a) each synthesis produces a different type of product or (b) each synthesis is a different type of reaction.

(2) Note. The following are considered to be different types of product: (a) A nonhydrocarbon. (b) An alicyclic hydrocarbon (naphthene, terpene) (c) An aromatic hydrocarbon (including aralkyl compounds) (d) An unsaturated hydrocarbon (olefin, diolefin, alkyne) (e) A saturated hydrocarbon (paraffin, isoparaffin)

(3) Note. The following are considered to be different types of reactions. The subclasses of this class concerned with such type reaction, per se, may be found in the Search this Class, Subclass Notes below:

(a) Condensation of entire hydrocarbon molecules (polymerization, alkylation;

(b) Alkyl transfer

(c) Skeletal isomerization;

(d) Shift of double bond;

(e) Removal of nonhydrocarbon element;

(f) Carbon content reduction;

(g) Dehydrogenation

(4) Note. Except for patents claiming process steps specifically provided for in subclasses 311-316, patents are placed in this and its indented subclasses on the basis of the ultimate product of an entire claimed plural serial diverse synthesis process; the patent placed as an original in the first appearing subclass which provides for such ultimate product and is cross-referenced to: a. Other of these subclasses appropriate for other ultimate or intermediate products produced by two or more diverse synthesis steps and b. to every subclass which provides for a synthesis step which is more than nominally included in any claim. A nominal recitation is a mere mention of a step, e.g., "dehydrogenation".

(5) Note. A process in which a single synthesis step is followed by a reaction which merely converts a by-product of the synthesis to material identical with the feedstock is not considered to be plural syntheses. See subclasses 905.

(6) Note. The occurrence of several phenomena simultaneously in a single step, e.g., alkylation and isomerization, etc., does not call for classification here (subclasses 310+). Rather, a patent claiming such a process step is classified in the first appearing subclass concerned with either phenomenon and crossed to the subclass dealing with the other.

SEE OR SEARCH THIS CLASS, SUBCLASS:

251+, and 254+, for a plural serial diverse synthesis process in which one step is hydrogenation.

353+, 439, 476, 483+, 539, 613+, 648+, 752, for Carbon content reduction. (see (3) Note above)

353+, 358, 365+, 371+, 404+, 476, 477+, 671, 734+, for Skeletal isomerization. (see (3) Note above)

357+, 436+, 469+, 603+, 637, 638+, 711, 733, for Removal of nonhydrocarbon element. (see (3) Note above)

361+, 364, 375+, 406, 415+, 422+, 438, 446+, 502+, 709+, for Condensation of entire hydrocarbon molecules (polymerization, alkylation.(see (3) Note above)

363, 377+, 664+, for Shift of double bond. (see (3) Note above)

375+, 470+, 643+, 708, for Alkyl transfer. (see (3) Note above)

379+, 430+, 440+, 540+ 616+, 654+, for Dehydrogenation. (see (3) Note above)

930+, for a collection of patents drawn to processes which involve synthesis of a nonhydrocarbon intermediate.

311 One synthesis rehabilitates catalyst for other, e.g., by alkylation with ester, etc.:

This subclass is indented under subclass 310. Subject matter in which a catalyst which has deteriorated in its effectiveness in a synthesis process is treated to restore its effectiveness by using it in another hydrocarbon synthesis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

301, and 702+, for a process in which a catalyst is used in plural distinct treatments, its use in one treatment sometimes serving, incidentally, to improve its effectiveness in the other treatment.

328, for a process in which a nonhydrocarbon material, e.g., aluminum trialkyl, reacts in a "growth" reaction with an olefin to form a higher alkyl nonhydrocarbon, and the alkyl is replaced by a lower carbon-content hydrocarbon leaving the original nonhydrocarbon reactant.

312 Same catalyst, solvent, or component thereof used in both syntheses:

This subclass is indented under subclass 310. Subject matter wherein a catalyst, solvent, diluent, or a material which makes up part of such substance is used in both of the syntheses.

(1) Note. Use of different portions of an extraneous material in both syntheses is not sufficient for placement of a patent in this subclass.

(2) Note. Where both syntheses use an extraneous agent drawn from and returned to a common pool or reservoir, the patent is placed here.

(3) Note. Use of a material as a catalyst in one reaction and as a reactant in a second reaction, e.g., use of HF catalyst from one reaction to form alkyl fluoride in another, does not provide a basis for classification in this subclass.

313 Entire catalyst composition:
This subclass is indented under subclass 312. Subject matter wherein the extraneous material employed in both syntheses includes all of the catalytic material used in each synthesis in the same proportions relative to each other.

314 With hydrocarbon effluent stream splitting for recycle to different syntheses:
This subclass is indented under subclass 310. Subject matter wherein the effluent from a single reaction is split and portions of the effluent are sent to different ones of the serial syntheses.

315 With hydrocarbon recycle from later to earlier synthesis:
This subclass is indented under subclass 310. Subject matter in which hydrocarbon material effluent from one synthesis is passed to a diverse synthesis through which diverse synthesis zone the hydrocarbon or its precursor has passed before.

316 Earlier synthesis is condensation or alkyl transfer:
This subclass is indented under subclass 315. Subject matter wherein the earlier synthesis is a condensation reaction, that is, polymerization, alkylation, etc., or an alkyl transfer (disproportionation) reaction.

SEE OR SEARCH THIS CLASS, SUBCLASS:
361+, 364, 406, 415+, 422+, 438, 446+, 502+, and 709+, for condensation reactions, per se.
375+, 470+, 643+, and 708, for alkyl transfer reactions, per se.

317 To produce alicyclic:
This subclass is indented under subclass 310. Subject matter wherein the ultimate product or an intermediate product, produced by at least two diverse conversions, is a nonaromatic cyclic material.

SEE OR SEARCH THIS CLASS, SUBCLASS:
350+, for the production of alicyclic compounds by a single synthesis step or a process performing similar syntheses in plural serial stages.

318 Having unsaturated ring:
This subclass is indented under subclass 317. Subject matter wherein the product has olefinic unsaturation in a ring.

319 To produce aromatic:
This subclass is indented under subclass 310. Subject matter in which the ultimate product or an intermediate product, produced by at least two diverse conversions, is an aromatic.

SEE OR SEARCH THIS CLASS, SUBCLASS:
400+, for the production of an aromatic compound by a single synthesis step or by a process performing similar syntheses in plural serial stages.

320 Polycyclic:
This subclass is indented under subclass 319. Subject matter which the product has more than one ring.

(1) Note. One or more of the rings may be alicyclic, but if the product contains one or more aromatic rings, the patent is proper for this subclass.

321 Having plural side-chains:
This subclass is indented under subclass 319. Subject matter wherein the product is an aromatic hydrocarbon having two or more hydrocarbyl substituents on the aromatic ring.

(1) Note. Any or all of the side-chains may be saturated (alkyl), unsaturated (alkenyl, alkylidene), etc.

322 Including an aromatization step:
This subclass is indented under subclass 319. Subject matter wherein a step converts a nonaromatic moiety to an aromatic moiety, e.g., by dehydrogenation of an alicyclic moiety, ring formation from an open-chain moiety, etc.

323 Including an alkylation step:
This subclass is indented under subclass 319. Subject matter wherein the series of conversions includes an alkylation step wherein an acyclic material is condensed with an aromatic material.

SEE OR SEARCH THIS CLASS, SUBCLASS:
446+, for alkylation of aromatics, per se.

324 To produce unsaturate:
This subclass is indented under subclass 310. Subject matter in which the ultimate product or an intermediate product, produced by at least two diverse conversions, is noncyclic and contains olefinic unsaturation.

SEE OR SEARCH THIS CLASS, SUBCLASS:
500+, for the production of unsaturated noncyclic compounds by single synthesis step or a process performing similar syntheses in plural serial stages.

325 Having triple bond:
This subclass is indented under subclass 324. Subject matter wherein the ultimate product or an intermediate product, produced by at least two diverse conversions, contains acetylenic unsaturation.

SEE OR SEARCH THIS CLASS, SUBCLASS:
534+, for the production of triple-bond material by a single synthesis step or a process performing similar syntheses in plural serial stages.

326 Polyolefin:
This subclass is indented under subclass 324. Subject matter wherein the olefinic unsaturation comprises two or more olefinically unsaturated bonds.

SEE OR SEARCH THIS CLASS, SUBCLASS:
506+, 600 and 601+, for the production of polyolefins by a single synthesis step or a process performing similar syntheses in plural serial stages.

327 From O compound feed or intermediate:
This subclass is indented under subclass 326. Subject matter wherein some or all of the carbon atoms appearing in the final product are introduced to the process as a compound which contains oxygen or during the course of the process appear in such a compound.

(1) Note. Patents classified herein are not cross-referenced to subclass 934.

SEE OR SEARCH THIS CLASS, SUBCLASS:
604+, and 606+, for, per se, synthesis of diolefin from an oxygen compound.

328 Including displacement from nonhydrocarbon by entire hydrocarbon molecule, e.g., growth reaction, etc.:
This subclass is indented under subclass 324. Subject matter wherein one step uses as reactants (1) a hydrocarbon, usually a low molecular weight olefin and (2) a nonhydrocarbon containing (a) one or more hydrocarbyl moieties and (b) a nonhydrocarbon atom or radical, the reaction serving to unite reactant (1) with atom or radical (2b) and to release a free olefin derived from (2a).

SEE OR SEARCH THIS CLASS, SUBCLASS:
637, for a displacement reaction, per se.

SEE OR SEARCH CLASS:
260, Chemistry of Carbon Compounds, subclass 448 for synthesis of an aluminum alkyl by a chain-growth reaction.

329 Including polymerization of olefin:
This subclass is indented under subclass 324. Subject matter which includes a step of condensing two or more entire olefin molecules.

SEE OR SEARCH THIS CLASS, SUBCLASS:
502+, for olefin polymerization, per se.

330 And a preliminary unsaturation step, e.g., cracking, dehydrogenation, etc.:
This subclass is indented under subclass 329. Subject matter wherein the polymerization step is subsequent to a step wherein the hydrogen content of a hydrocarbon molecule is reduced.

(1) Note. The polymerization step can immediately follow the cracking or dehydrogenation, or the unsaturation and polymerization can be separated by one or more other steps.

SEE OR SEARCH THIS CLASS, SUBCLASS:
613+, and 648+, for a cracking reaction, per se, to produce a diolefin or a monoolefin, respectively.
616+, and 654+, for a dehydrogenation reaction, per se, to produce a diolefin or monoolefin, respectively.

331 Including alkylation to produce branched-chain paraffin:
This subclass is indented under subclass 310. Subject matter wherein a non-normal saturated noncyclic hydrocarbon is produced, including a step of condensing an olefin-acting material with a nonolefinically unsaturated material.

SEE OR SEARCH THIS CLASS, SUBCLASS:
446+, and 709+, for an alkylation reaction per se to produce an aromatic or a saturated noncyclic compound, respectively.

332 And preliminary isomerization or polymerization:
This subclass is indented under subclass 331. Subject matter wherein a material undergoing the alkylation synthesis has undergone a reaction wherein a feedstock is converted to another material having the same empirical formula but a different structural configuration, or in which an olefin has been condensed with one or more other olefin molecules.

SEE OR SEARCH THIS CLASS, SUBCLASS:
502+, for olefin polymerization, per se.
664+, for olefin synthesis by double bond shift isomerization.
734+, for skeletal isomerization of paraffins.

350 ALICYCLIC COMPOUND SYNTHESIS:
This subclass is indented under the class definition. Subject matter wherein a chemical change produces a hydrocarbon which is cyclic or has a cyclic moiety, the hydrocarbon having no aromatic rings.

(1) Note. This subclass is the locus for patents drawn to certain skeletal isomerization phenomena which yield a monocyclic compound. Such phenomena include:

(a)a change in the relative position of the alkyl group on a ring, such as a shift of an alkyl group from the ortho to the meta or para position thereon, (b) a change of the side-chain size in which a portion of the alkyl group is transferred to another position on the ring, but the total number of carbon atoms on the ring remains the same, (c) a rearrangement of the side-chain on a ring, for example, a normal propyl group on the ring changed into an isopropyl, (d) a change from a cisconfiguration to a trans-configuration.

SEE OR SEARCH THIS CLASS, SUBCLASS:
266+, for hydrogenation of an aromatic to produce an alicyclic.
317+, for production of an alicyclic by serial diverse syntheses.
353, and 360, for skeletal isomerization processes which produce a polycyclic nonaromatic.
365+, for production of an alicyclic ring from a nonring hydrocarbon by a cyclization isomerization.
371+, for isomerizaton of a larger-ring compound to a smaller-ring compound and vice versa.
377+, for double bond shift isomerization to produce a monocyclic nonaromatic.
476+, and 477+, for skeletal isomerization processes which produce a compound having an aromatic ring.
600, 601 and 671, for skeletal isomerization processes which produce an olefin.
734+, for skeletal isomerization processes which produce a paraffin.

SEE OR SEARCH CLASS:

208, Mineral Oils: Processes and Products, subclasses 133+ for reforming mineral oils which may include isomerization.

351 Carotene or derivative:

This subclass is indented under subclass 350. Subject matter directed to the production of carotene (Fig. 1) and compounds in which a hydrogen of the carotene nucleus is replaced by a hydrocarbyl moiety.

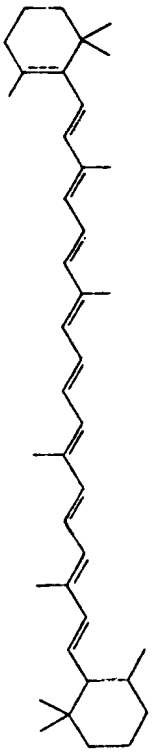


FIGURE 1. carotene

352 Adamantane or derivative:

Subject matter under 350 directed to the production of the adamantane nucleus, $C_{10}H_{16}$ (Fig. 1) and compounds in which a hydrogen of the adamantane nucleus is replaced by a hydrocarbyl moiety.

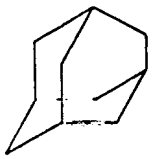


Fig. 1

353 By shift, opening, or removal of shared-carbon ring:

This subclass is indented under subclass 350. Subject matter in which a shared-carbon ring, e.g., a bridge, is shifted from attachment to one carbon of a ring to another carbon, as in terpene isomerization, or a shared-carbon ring is opened or removed to give a product containing fewer rings than the feed material.

(1) Note. The polycyclic feed may have ortho-fused rings or one ring may bridge another, or the rings may be spiro.

SEE OR SEARCH THIS CLASS, SUBCLASS:

476, for the synthesis of an aromatic compound by ring opening, removal, degradation, or shift.

940, for a collection of patents in which a hydrocarbon ring is opened.

354 Cyclopentadiene from its polymer:

This subclass is indented under subclass 353. Subject matter in which a polymer of cyclopentadiene, e.g., dicyclopentadiene (Fig. 1) is converted to cyclopentadiene.

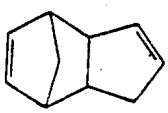


FIGURE 1.

355 Camphene or ten-C monocyclic from polycyclic, e.g., terpene isomerization, etc.:

This subclass is indented under subclass 353. Subject matter wherein the feedstock to the reaction is a material having more than one ring and the product is camphene (Fig. 1) or a hydrocarbon having one alicyclic ring and ten carbon atoms.

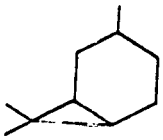
FIGURE 1.

(1) Note. Because most dictionaries do not carry a list of C_{10} terpenes, the following list, although incomplete, is presented as a guide to such materials:

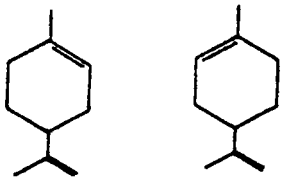
Carvestrene: racemic mixture of sylvestrene optical isomers (no illustration). Dipentene: racemic mixture of limonene optical isomers. (no illustration)

Bornane

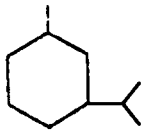
2-Bornene



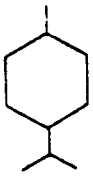
Carane



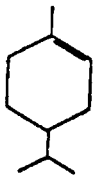
Limonene (Dipentene)



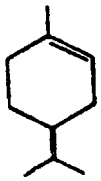
m-Menthane



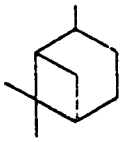
p-Menthane



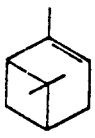
1-p-Menthene



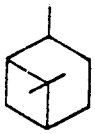
1,4(8)-p-Menthadiene (Terpinolene)



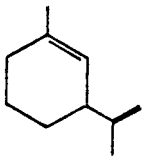
Pinane

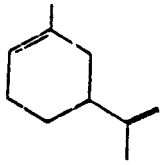


alpha-Pinene

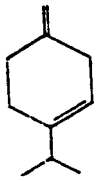


beta-Pinene

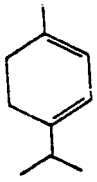




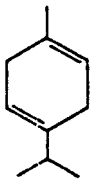
Sylvestrene



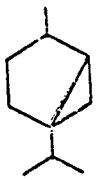
beta-Terpinene



alpha-Terpinene

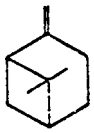


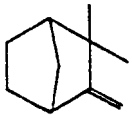
gamma-Terpinene



Thujane

356 **Camphene from pinene or derivative:**
This subclass is indented under subclass 355. Subject matter represented by the equation





357 **From nonhydrocarbon:**
This subclass is indented under subclass 350. Subject matter in which the feedstock to the process contains an element other than carbon and hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
408+, 454, 469, 603+, 638+, 711, and 733, for synthesis of other hydrocarbons from nonhydrocarbon feedstocks.

358 **Nonring moiety becomes ring:**
This subclass is indented under subclass 357. Subject matter wherein the product contains at least one more ring than the feedstock.

SEE OR SEARCH THIS CLASS, SUBCLASS:
365, and 407, for other cyclization processes.

359 **Halogen containing:**
This subclass is indented under subclass 357. Subject matter wherein the nonhydrocarbon contains fluorine, chlorine, bromine, or iodine.

360 Polycyclic product:
This subclass is indented under subclass 350. Subject matter wherein a hydrocarbon is synthesized having more than one alicyclic moiety.

(1) Note. The rings may be directly connected to each other or may be substituents on an acyclic chain.

(2) Note. Here is found the production of bicyclo or "bridge" compounds, e.g., bicyclo [2,2,1] heptane.

361 By condensation, e.g., diels-alder reaction, etc.:
This subclass is indented under subclass 360. Subject matter wherein two or more molecules are joined together in their entirety to synthesize the desired product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
427+, for a process wherein two or more aromatic molecules are condensed.
446+, for alkylation of an aromatic compound.

362 Dimerizing a cycloolefin:
This subclass is indented under subclass 361. Subject matter wherein an alicyclic compound having olefinic unsaturation in the ring or in a side-chain is condensed with itself to form a compound having more than one ring.

(1) Note. Many processes herein are designed to remove cyclopentadiene impurities from a hydrocarbon stream by dimerizing the impurities.

SEE OR SEARCH THIS CLASS, SUBCLASS:
832, for a process where a hydrocarbon stream is purified by polymerizing a component and resolving the polymer to the monomer.

363 By double-bond shift in side-chain:
This subclass is indented under subclass 360. Subject matter wherein the product is synthesized by isomerization of a double bond from one position to another position in the side-chain of the molecule, e.g., from vinyl to ethylidene, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
377+, for a double-bond shift in a monocyclic nonaromatic compound.
435+, for a similar shift in an aromatic compound.
664+, for a similar shift in a noncyclic olefin.

364 By condensive ring expansion, e.g., "olefin dismutation", etc.:
This subclass is indented under subclass 350. Subject matter wherein the alicyclic compound is synthesized from a feedstock molecule, usually a cycloolefin, having fewer carbons in its ring than the product molecule, the carbons added to the ring being contributed by another molecule.

(1) Note. The final product may incorporate all of the carbon atoms of the feedstock molecules (polymerization) or only part of the carbon atoms of one feedstock (disproportionation).

SEE OR SEARCH THIS CLASS, SUBCLASS:
362, for cycloolefin dimerization in which the product has plural rings.
643+, for olefin disproportionation reactions aimed at the production of acyclic monoolefins. Many of the catalysts used in such reactions are disclosed as being useful in the reactions of this subclass (364).

365 From nonring hydrocarbon:
This subclass is indented under subclass 350. Subject matter directed to the conversion of an acyclic hydrocarbon to an alcyclic hydrocarbon.

SEE OR SEARCH THIS CLASS, SUBCLASS:
358, for a cyclization process in which the feed is a nonhydrocarbon.
407+, for a cyclization process which produces an aromatic.

366 Alkadiene:
This subclass is indented under subclass 365. Subject matter wherein the feedstock includes a noncyclic hydrocarbon chain having two olefinically unsaturated bonds.

SEE OR SEARCH THIS CLASS, SUBCLASS:
361, for a process in which an acyclic olefin, e.g., an alkadiene, etc., is condensed with a cyclic olefin to produce a polycyclic nonaromatic hydrocarbon.

367 Using refractory-group metal-containing catalyst:
This subclass is indented under subclass 366. Subject matter employing a catalyst which contains in free or combined form a transition metal of Group IV, V, or VI, that is, titanium, zirconium, hafnium, vanadium, niobium (columbium), tantalum, chromium, molybdenum, or tungsten.

368 With nonmetal element or compound:
This subclass is indented under subclass 367. Subject matter employing, in addition to the refractory metal component, an element or compound which does not contain a metal atom.

(1) Note. The nonmetal element or compound must be clearly an entity separate from the metal-containing material, that is, it is not part of a "complex" with a metal-containing "compound".

(2) Note. The nonmetal element or compound need not have a clearly catalytic function, but may be described as a solvent, diluent, etc.

369 Using Co-, Fe-, or Ni-containing catalyst:
This subclass is indented under subclass 366. Subject matter employing a catalyst which contains iron or cobalt or nickel in free or combined form.

370 With nonmetal organic compound:
This subclass is indented under subclass 369. Subject matter employing, in addition to the iron group metal material, an organic compound which does not contain a metal atom.

371 By ring expansion or contraction:
This subclass is indented under subclass 350. Subject matter wherein a ring is made smaller or larger.

(1) Note. The distinction in subject matter between this subclass and subclasses 365+ is as follows: In this subclass a ring which is present in a molecule at the start of the process contains more carbon atoms or less carbon atoms at the end of the process. The phenomena involved are both ring opening and ring closing. In subclasses 365+ a molecule or moiety which is not a ring at the start of the process is a ring or part of a ring at the end of the process.

SEE OR SEARCH THIS CLASS, SUBCLASS:
322, for a process wherein methylcyclopentane is converted to cyclohexane and the later compound is dehydrogenated to benzene.

372 Using Al group metal halide catalyst:
This subclass is indented under subclass 371. Subject matter using a catalyst comprising a fluoride, chloride, bromide, or iodide of aluminum, gallium, indium, or thallium.

373 With added hydrocarbon complex or non-hydrocarbon organic agent:
This subclass is indented under subclass 372. Subject matter using also a hydrocarbon complex (usually sludge type) or an organic material containing an element other than carbon and hydrogen.

374 Using metal-containing catalyst:
This subclass is indented under subclass 371. Subject matter using a catalyst which contains a metal or a compound of a metal.

375 By alkylation or alkyl transfer:
This subclass is indented under subclass 350. Subject matter wherein the alicyclic compound is synthesized by (a) condensation of an alicyclic with an acyclic moiety which may be all or part of another hydrocarbon molecule or by (b) dealkylation of the alicyclic molecule wherein the removed alkyl is condensed with another hydrocarbon molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:

446, and 709, for other alkylation reactions.

470, and 643, for other alkyl transfer reactions.

376 Feed has side-chain:
This subclass is indented under subclass 375. Subject matter in which the feed to the process has an alicyclic ring with an acyclic side-chain.

(1) Note. The alkylation may involve the side-chain or the ring.

377 By double-bond shift:
This subclass is indented under subclass 350. Subject matter wherein the product is synthesized by isomerization of a double bond from one position to another position in the molecule.

(1) Note. The shift may be within a ring, within a side-chain, from a ring to a side-chain, etc.

378 Using organometallic compound, P- or S-containing catalyst:
This subclass is indented under subclass 377. Subject matter using a catalyst which is an organometallic compound or contains phosphorus or sulfur.

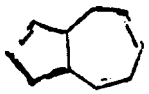
379 By dehydrogenation:
This subclass is indented under subclass 350. Subject matter wherein the synthesis involves removal of hydrogen from an alicyclic molecule.

380 Using H acceptor:
This subclass is indented under subclass 379. Subject matter wherein hydrogen is removed from a desired hydrocarbon by use of another substance which chemically reacts with and combines with the hydrogen.

(1) Note. The other substance may be an element, e.g., oxygen, etc., or a compound e.g., an unsaturated hydrocarbon, etc.

400 AROMATIC COMPOUND SYNTHESIS:
This subclass is indented under the class definition. Subject matter drawn to a process which includes a chemical change and results in a recoverable hydrocarbon compound having at least one carbocyclic ring, usually six-membered, which is resonating or is characterized by three conjugated double bonds.

(1) Note. Azulene (Fig. 1) is considered to be aromatic.



Azulene (Fig. 1)

(2) Note. Naphthalene (Fig. 1), dihydronaphthalene (Fig. 2), and tetrahydronaphthalene (Tetralin) (Fig. 3) are aromatic, but decahydronaphthalene (Decalin), (Fig. 4) is alicyclic.

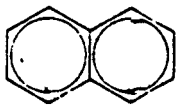


FIGURE 1. Naphthalene

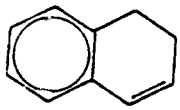


FIGURE 2. dihydronaphthalene

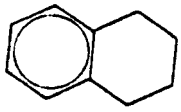


FIGURE 3. tetrahydronaphthalene (Tetralin)

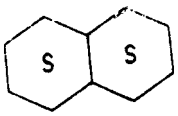


FIGURE 4. decahydronaphthalene (Decalin)

(3) Note. This subclass (400) is the locus for processes wherein carbon atoms already contained in rings are joined to form an additional ring or wherein a nonaromatic ring moiety of a polycyclic aromatic hydrocarbon is dehydrogenated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

24+, for patents which claim an aromatic hydrocarbon compound.

319+, for a synthesis process involving diverse conversions leading to production of a recoverable aromatic compound.

804+, for a process for purifying an aromatic compound by plural diverse serial separations.

827+, and 831, for a purification process in which an aromatic compound is sorbed by a solid sorbent.

SEE OR SEARCH CLASS:

208, Mineral Oils: Processes and Products, appropriate subclasses, especially subclasses 133+, for a process for synthesizing a mixture of aromatic compounds from a mineral oil mixture when there is no recovery of a particular aromatic compound.

401 With measuring, sensing, testing, or synthesis operation control responsive to diverse condition:

This subclass is indented under subclass 400. Subject matter wherein the process involves a definitely recited step of measuring, analyzing, etc., a condition or parameter of the process or in which a condition of the synthesis operation, e.g., temperature, etc., is adjusted in accordance with a different aspect of the synthesis, e.g., strength of catalyst, etc.

(1) Note. A process in which the same operating condition is controlled, e.g., adding heat to a reaction in response to a temperature drop in the reaction zone, is not included in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

501, and 701, for similar procedures employed in the synthesis of unsaturated and saturated hydrocarbon compounds, respectively,

956, for a collection of patents disclosing such procedures in other aspects of hydrocarbon processing.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for processes and apparatus for making a measurement or test of any kind not claimed in combination with synthesis of an organic compound and not elsewhere classifiable, and the class definition thereof for the identification of other classes concerned with testing.

436, Chemisty: Analytical and Immunological Testing, subclass 1H for chemical reaction not elsewhere classifiable, or analysis by chemical methods of organic material.

402 Exploiting or conserving heat of quenching, reaction, or regeneration:

This subclass is indented under subclass 400. Subject matter in which heat generated by a reaction or by catalyst regeneration or absorbed by quenching reactants is put to use in the process.

(1) Note. Patents placed wherein are not cross-referenced to subclass 910.

SEE OR SEARCH THIS CLASS, SUBCLASS:

503, 535, 602, and 634, for olefin condensation, alkyne synthesis, diolefin synthesis, and saturated compound synthesis, respectively, using similar techniques.

910, for a collection of patents where similar techniques are employed in other syntheses.

403 Using apparatus of recited composition:
This subclass is indented under subclass 400. Subject matter wherein the process uses apparatus made of a particular material, e.g., a ceramic, stainless steel, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
402, for a process in which the apparatus of recited composition is a heat carrier.
503, 537 and 636, for olefin condensation, alkyne synthesis, and monoolefin synthesis, respectively, using apparatus of recited composition.
920, for a collection of patents using such apparatus in other processes.
950, for a collection of patents disclosing prevention of solid deposits on apparatus by forming a permanent or temporary protective coating of named composition on the surfaces of same.

404 By ring expansion or contraction:
This subclass is indented under subclass 400. Subject matter wherein a change in ring size and usually also dehydrogenation (removal of hydrogen from the ring) takes place.

SEE OR SEARCH THIS CLASS, SUBCLASS:
371+, for ring expansion or contraction phenomena in the synthesis of an alicyclic.

405 Using transition metal-containing catalyst:
This subclass is indented under subclass 404. Subject matter wherein the reaction takes place in the presence of a catalyst containing a transition metal in free or combined form.

(1) Note. The transition metals are elements in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table they include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

406 By dimerization of vinyl aromatic:
This subclass is indented under subclass 400. Subject matter which comprises the condensation of two molecules of a vinyl aromatic compound, e.g., styrene, etc.

(1) Note. The dimer may be one of several types of products or a mixture of the several types, such as diplenyl alkenes, phenylindanes, etc.

407 By ring formation from nonring moiety, e.g., aromatization, etc.:
This subclass is indented under subclass 400. Subject matter wherein carbon atoms which make up a ring or part of a ring in the desired aromatic product enter the reaction as part of an acyclic moiety.

(1) Note. Where a ring is formed by the joining together of carbon atoms already contained in one or more rings of a molecule, e.g., conversion of dinaphthyl to perylene, etc., classification in subclass 400 is proper.

SEE OR SEARCH THIS CLASS, SUBCLASS:
358, and 365, for a similar phenomenon in the manufacture of an alicyclic hydrocarbon.
406, for a similar phenomenon where the moiety is the side-chain of a vinyl aromatic.

408 Nonhydrocarbon feed:
This subclass is indented under subclass 407. Subject matter where the starting material contains at least one element other than carbon and hydrogen, e.g., chlorine, oxygen, etc.

409 Aromatic or carbonyl-containing reactant:
This subclass is indented under subclass 408. Subject matter in which material sent into the process, which supplies carbon atoms for the desired product, has a keto or aldehyde moiety and/or an aromatic ring or ring structure.

410 Aromatic feed:
This subclass is indented under subclass 407. Subject matter in which material sent into the process, which supplies carbon atoms for the

desired product, contains an aromatic ring or ring structure.

(1) Note. The desired product usually is polycyclic.

SEE OR SEARCH THIS CLASS, SUBCLASS:
409, for a similar process in which the aromatic feedstock or an accompanying feedstock contains an atom other than carbon or hydrogen.

411 Using metal-containing catalyst:
This subclass is indented under subclass 410. Subject matter catalyzed by a material containing metal in free or combined form, e.g., clay, etc.

412 Plural stage, with moving catalyst or with specified flow rate or procedure:
This subclass is indented under subclass 407. Subject matter wherein the synthesis is accomplished in two or more steps, wherein the catalyst employed is claimed as moving, e.g., from reactor to regenerator, fluidized, etc., wherein a flow procedure in the reactor, e.g., countercurrent, etc., is claimed, or wherein a flow rate, e.g., space velocity of reactant, etc., is claimed.

(1) Note. A mere time span during which the desired reaction takes place is not sufficient for classification in this subclass.

413 With preliminary treatment of feed or plural separation procedures:
This subclass is indented under subclass 407. Subject matter wherein the effluent from the aromatization reaction or a component thereof passes through at least two separation steps or wherein a feedstock is treated prior to the aromatization reaction, e.g., by separation into fractions, by preheating, etc.

414 Using metal-free H acceptor:
This subclass is indented under subclass 407. Subject matter wherein the synthesis process employs a nonmetal element or a compound not containing a metal, which chemically reacts with hydrogen removed from a feedstock, the element or compound thereby being changed to a more hydrogenated material.

SEE OR SEARCH THIS CLASS, SUBCLASS:
257, for a process wherein a hydrocarbon is the acceptor and the more hydrogenated hydrocarbon is a desired product.

415 Product compound has more C atoms than feed compound, e.g., cyclic polmerization, etc.:
This subclass is indented under subclass 407. Subject matter in which the aromatic product of the synthesis contains more carbon atoms than a feedstock compound which supplies carbon atoms to the said product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
502, for polymerization processes which produce a nonsolid olefin hydrocarbon.
700, for apolymerization process which produces a saturated hydrocarbon product.

416 Triple bond-containing feed:
This subclass is indented under subclass 415. Subject matter in which the ring is formed from acetylene or a substituted acetylene.

SEE OR SEARCH THIS CLASS, SUBCLASS:
410, for ring formation from the sidechains or aryl-substituted acetylenes.

417 Using transition metal-containing catalyst:
This subclass is indented under subclass 415. Subject matter wherein the reaction takes place in the presence of a catalyst containing a transition metal in free or combined form.

(1) Note. The transition metals are elements in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table they include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

418 Using transition metal-containing catalyst:
This subclass is indented under subclass 407. Subject matter wherein the reaction takes place in the presence of a catalyst containing a transition metal in free or combined form.

(1) Note. The transition metals are elements in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table they include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium, 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

419 Group VIII noble metal:
This subclass is indented under subclass 418. Subject matter wherein the catalyst contains platinum, palladium, rhodium, ruthenium, iridium, or osmium.

420 Group VI metal:
This subclass is indented under subclass 418. Subject matter wherein the catalyst contains chromium, molybdenum, or tungsten.

421 With alkaline metal compound:
This subclass is indented under subclass 420. Subject matter where one component of the catalyst is a compound of an alkali metal or alkaline earth metal, e.g., lithium, sodium, potassium, rubidium, cesium, beryllium, magnesium, calcium, strontium, barium, or radium.

422 By condensation of entire cyclic molecules or entire hydrocarbyl moieties thereof, e.g., polymerization, etc.:
This subclass is indented under subclass 400. Subject matter in which a polycyclic aromatic is produced by joining two or more entire cyclic molecules of a feedstock or the entire hydrocarbyl moieties of such molecule.

(1) Note. This subclass (422) is the locus for a process where a side-chain carbon of one molecule is joined to the ring carbon of another molecule, e.g., the manufacture of phenyl tolyl methane from toluene.

SEE OR SEARCH THIS CLASS, SUBCLASS:
361+, for analogous processes where none of the feedstock molecules is aromatic.
438, and 446+, for a process wherein an aromatic ring moiety is condensed with a nonring moiety.
470, for a process wherein an aromatic compound is manufactured by condensation of a molecule with a fragment of another molecule.
502+, and 709+, for a condensation process wherein nonring moieties are condensed.

423 With plural separation procedures:
This subclass is indented under subclass 422. Subject matter wherein a material, usually the effluent from the condensation reaction or a component thereof, passes through at least two separation steps.

(1) Note. A mere nominal “recovery” or “separating” step is not sufficient to warrant placement of a patent herein.

(2) Note. Many patents contained herein recycled a separated component.

SEE OR SEARCH THIS CLASS, SUBCLASS:
424, for a process wherein the condensation effluent is subjected to another condensation reaction.
702+, 705 and 706, for paraffin syntheses in general which may or do involve specifically directed separation or purification procedures.
710, and 712, for alkylation procedures which produce a paraffin, involving specifically directed purification or separation procedures.

424 Plural stage or with preliminary treatment of feed:
This subclass is indented under subclass 422. Subject matter wherein the effluent from an aromatic condensation reaction or wherein a feed stock is treated prior to the condensation reaction, e.g., by separating nonhydrocarbons therefrom, by separating the feed into several different fractions, by heating, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

300+, for a process wherein two or more reactions are conducted in parallel.

320, for a process wherein an intermediate is formed in an aromatic synthesis process which results in a polycyclic product.

425 Ring carbon of one molecule joined to ring carbon of other:

This subclass is indented under subclass 422. Subject matter in which the condensation exploits ring carbon atoms of two feed molecules, for example, by fusing rings, forming biphenyl from benzene, etc.

426 Through residue of nonring molecule, e.g., acetylene, etc.:

This subclass is indented under subclass 425. Subject matter in which a moiety, present as an acyclic molecule in the feedstock, is present between the joined rings of the product.

427 Arylene bond formed using metal-containing agent:

This subclass is indented under subclass 425. Subject matter in which a biphenyl, polyphenyl, substituted biphenyl or polyphenyl, or partially hydrogenated biphenyl or polyphenyl is the product and the process employs an agent, e.g., a catalyst, a solvent, etc., which is or contains a metal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

268, for a process in which hydrogenation of an aromatic ring takes place simultaneously with formation of the arylene bond, e.g., hydrodimerization of benzene, etc.

428 Nonring moiety of one molecule bonded to nonring moiety of other, e.g., polystyrene, etc.:

This subclass is indented under subclass 422. Subject matter in which ring-containing molecules having side-chain or other acyclic components are joined by means of the acyclic components, the ring moieties becoming mere substituents on the resulting condensed acyclic moiety.

SEE OR SEARCH THIS CLASS, SUBCLASS:

406, for a process where only two molecules of a vinyl aromatic are condensed with each other.

502+, for polymerization of olefins which do not have an aromatic substituent.

SEE OR SEARCH CLASS:

526, Synthetic Resins or Natural Rubbers, subclass 346 for solid polystyrene resins and methods of manufacture.

429 Through residue of nonring molecule, e.g., butadiene, etc.:

This subclass is indented under subclass 428. Subject matter wherein a moiety, present as an acyclic molecule in the feedstock, is present between the joined acyclic components of the ring-containing feedstock material.

430 From alicyclic:

This subclass is indented under subclass 400. Subject matter in which an aromatic hydrocarbon is formed from a cyclic material having the same number of carbon atoms in its ring system, which cyclic material in nonaromatic.

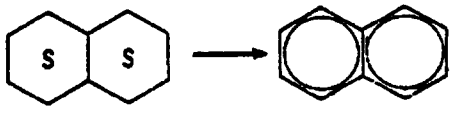
SEE OR SEARCH THIS CLASS, SUBCLASS:

266+, for the opposite reaction.

400, for conversion of a polycyclic material having an aromatic ring to one having more aromatic rings, e.g., conversion of tetralin to naphthalene, etc.

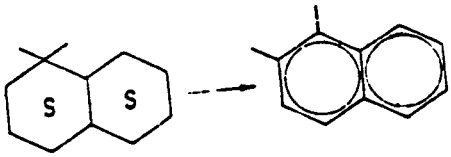
431 Polycyclic product of with olefinic unsaturation in feed:

This subclass is indented under subclass 430. Subject matter wherein the aromatic hydrocarbon is made from a feed compound having an olefinic double bond or in which the aromatic hydrocarbon formed is polycyclic, e.g.,



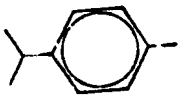
decahydronaphthalene, naphthalene

bycyclo (6,4,0) dodecadiene , benzosuberane



1,1-dimethydecalin ; 1,2,dimethylnapthalene

432 Cymene product:
This subclass is indented under subclass 431. Subject matter wherein cymene is the aromatic hydrocarbon formed, e.g., p-cymene.



(1) Note. Often the feed is a terpene.

433 Using H acceptor or Cr-, Mo-, or W- containing catalyst:
This subclass is indented under subclass 430. Subject matter wherein a material is employed which forms a compound with the hydrogen removed from the feedstock or which contains, chromium, molybdenum, or tungsten in free or combined form.

(1) Note. The hydrogen acceptor may be an element of a compound, the compound being a hydrocarbon or a nonhydrocarbon.

SEE OR SEARCH THIS CLASS, SUBCLASS:
257, for a hydrogen-exchange disproportionation process in which the hydrocarbon which becomes more saturated is a desired product of the process.
380, 442, 442, 617+, and 654+, for other dehydrogenation processes which use a hydrogen acceptor.
403, for aromatic manufacture where the hydrogen acceptor is embodied in the apparatus used.
900, for aromatic manufacture where a nonhydrocarbon acceptor is recycled, e.g., after rehabilitation.

434 Using noble metal catalyst:
This subclass is indented under subclass 430. Subject matter catalyzed by a noble metal, that is, gold, silver, platinum, palladium, rhodium, iridium, osmium, or ruthenium in free or combined form.

435 Having alkenyl moiety, e.g., styrene, etc.:
This subclass is indented under subclass 400. Subject matter in which the aromatic product of the synthesis process has olefinic or acetylenic unsaturation in a sidechain or other acyclic moiety.

(1) Note. Synthesis of an alkenyl aryl by disproportionation, i.e., transalkylation, is properly classified in this subclass.

436 Polycyclic product or from nonhydrocarbon feed:
This subclass is indented under subclass 435. Subject matter wherein the product has more than one ring or contains carbon or hydrogen atoms introduced to the process as part of a compound containing atoms other than carbon and hydrogen.

(1) Note. Only one of the rings needs to be aromatic for placement in this subclass.

437 O-containing feed:
This subclass is indented under subclass 436. Subject matter wherein a nonhydrocarbon feedstock compound contains an oxygen atom.

438 By condensation using metal-containing catalyst:
This subclass is indented under subclass 435. Subject matter wherein the product is formed by joining plural entire hydrocarbon molecules, e.g., “alkenylation”, “olefin arylation”, etc., and wherein a catalyst is employed which contains a metal in free or combined form.

SEE OR SEARCH THIS CLASS, SUBCLASS:

422+, for a similar process where two of the joined molecules contain rings.

436, and 446+, for other condensation processes which produce aromatics.

439 By C removal, e.g., cracking, etc.:

This subclass is indented under subclass 435. Subject matter in which carbon atoms are removed from a feedstock compound.

(1) Note. The removed carbon atoms are not thereupon joined to a second hydrocarbyl moiety to increase the carbon content of the second moiety.

SEE OR SEARCH THIS CLASS, SUBCLASS:

241, for depolymerization of aromatic-containing synthetic resin waste.

435, for production of an alkenyl aromatic by disproportionation, i.e., transalkylation.

476, and 483+, for similar processes wherein the aromatic product does not have an unsaturated nonring moiety.

440 By dehydrogenation:

This subclass is indented under subclass 435. Subject matter in which hydrogen atoms are removed from a feedstock compound to produce the product.

SEE OR SEARCH THIS CLASS, SUBCLASS:

257, for a hydrogen-exchange disproportionation process in which the hydrocarbon which becomes more saturated is a desired product of the process.

441 Plural stage or with plural separation procedures:

This subclass is indented under subclass 440. Subject matter wherein the effluent from a dehydrogenation reaction is sent to another dehydrogenation reaction or in which two or more separation steps are performed.

(1) Note. One or more of the separation steps may be preliminary to the reaction.

(2) Note. Frequently a compound separated from the effluent is recycled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

800+, and the notes thereto for separation procedures, per se, applied to hydrocarbon materials.

442 Using halogen or S:

This subclass is indented under subclass 440. Subject matter in which elemental or combined halogen or sulfur is added to the reaction mixture.

(1) Note. Often hydrogen from the compound which become the desired product chemically combines with a component of the halogen or sulfur compound.

443 Using elemental O:

This subclass is indented under subclass 440. Subject matter in which elemental oxygen, e.g., air, is added to the reaction mixture.

(1) Note. Usually hydrogen from the compound which becomes the desired product chemically combines with the elemental oxygen.

(2) Note. Processes described as “partial combustion” are placed here.

444 Using metal oxide, sulfide, or salt:

This subclass is indented under subclass 440. Subject matter wherein part or all of the synthesis takes place in the presence of an oxide, sulfide, or salt of a metal.

445 Cr-, Mo-, or W-containing:

This subclass is indented under subclass 444. Subject matter wherein the process uses chromium, tungsten, or molybdenum in free or combined form.

446 By condensation of entire molecules or entire hydrocarbyl moieties thereof, e.g., alkylation, etc.:

This subclass is indented under subclass 400. Subject matter wherein there is added to an aromatic hydrocarbon, or that moiety of an aromatic nonhydrocarbon which remains after atoms other than carbon and hydrogen have

been removed, an acyclic straight or branched hydrocarbon molecule or that moiety of an acyclic nonhydrocarbon which remains after atoms other than carbon and hydrogen have been removed.

(1) Note. The ring compound onto which the chain is introduced may already include one or more side-chains, e.g., toluene, xylene, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

470+, for a process in which a hydrocarbyl moiety which is only a part of a hydrocarbon molecule is added to an aromatic molecule.

709+, for alkylation of an olefin to produce a noncyclic hydrocarbon.

447 With specified flow rate through reactor or flow procedure within or at entrance to reactor:

This subclass is indented under subclass 446. Subject matter wherein a procedure for achieving contact and/or confluence of materials in the reactor or at the entrance to the reactor is specified, or in which the time which a reactant takes to flow through the reactor is specified.

SEE OR SEARCH THIS CLASS, SUBCLASS:

922+, for a collection of patents drawn to other hydrocarbon conversion processes wherein a reactor fluid manipulating device is specified.

955+, for a collection of patents drawn to other hydrocarbon synthesis processes in which a mixing procedure is specified.

448 With preliminary treatment of feed:

This subclass is indented under subclass 446. Subject matter wherein the hydrocarbon feed is treated prior to the alkylation reaction, e.g., by separating nonhydrocarbons therefrom, by separating the feed into several different fractions, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

323, for a process wherein an intermediate is formed in an aromatic synthesis process which includes an alkylation step.

449 Plural alkylation stages:

This subclass is indented under subclass 446. Subject matter in which the effluent from an aromatic alkylation reaction is sent to another aromatic alkylation reaction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

300+, for a process wherein two or more alkylation reactions are conducted in parallel.

323, for a process in which an aromatic alkylation reaction is preceded or followed by a conversion other than aromatic alkylation.

450 With plural separation procedures:

This subclass is indented under subclass 446. Subject matter wherein a material usually the effluent from the alkylation reaction or a component thereof, passes through at least two separation steps.

(1) Note. A mere nominal “recovery” or “separating” step is not sufficient to warrant placement of a patent herein.

(2) Note. Many patents contained herein recycle a separated component.

SEE OR SEARCH THIS CLASS, SUBCLASS:

449, for a process wherein the alkylation effluent is subjected to another alkylation reaction.

702+, 705 and 706, for paraffin syntheses in general which may or do involve specifically directed separation or purification procedures.

710, and 712+, for alkylation procedures which produce a paraffin, involving specifically directed purification or separation procedures.

451 Including dissolving or solids formation or separation:

This subclass is indented under subclass 450. Subject matter in which the separation procedure involves filtration, crystallization, use of solid sorbent, formation of a solid precipitate, washing, scrubbing, or other dissolving, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

800+, for such separation procedures applied to hydrocarbons without a claimed synthesis procedure.

452 Attachment to side-chain, e.g., telomerization, etc.:

This subclass is indented under subclass 446. Subject matter wherein the process results in the addition of carbon atoms to the side-chain of a feed aromatic compound.

SEE OR SEARCH THIS CLASS, SUBCLASS:

438, for a similar process which produces an aromatic compound having an unsaturated side-chain, e.g., by condensation of toluene and butadiene, etc.

471+, in which this same result is accomplished by alkyl transfer.

453 Resulting side-chain has less than four C atoms:

This subclass is indented under subclass 452. Subject matter wherein a methyl substituent of an aromatic ring becomes an ethyl or propyl substituent or in which an ethyl substituent becomes a propyl substituent.

454 Feed other than hydrocarbon, hydroxy, monohalide, or ether:

This subclass is indented under subclass 446. Subject matter in which a nonhydrocarbon molecule supplies a hydrocarbyl moiety which appears in the final product, the nonhydrocarbon not being a monohalide, a hydroxy compound, or an ether.

455 Resulting side-chain restricted to more than five c atoms, e.g., "detergent alkylate", etc.:

This subclass is indented under subclass 446. Subject matter wherein the product is an aromatic having a side-chain claimed in any claim as necessarily containing six or more carbon atoms.

(1) Note. A "detergent alkylate" is presumed to be a product having a side-chain of six or more carbon atoms.

456 Using halogen-containing catalyst:

This subclass is indented under subclass 455. Subject matter wherein the reaction is catalyzed by a material containing fluorine, chlorine, bromine, or iodine in free or combined form.

SEE OR SEARCH THIS CLASS, SUBCLASS:

462, for halogen-catalyzed alkylation to produce an aromatic where the side-chain is not restricted to six or more carbon atoms.

723+, for HF-catalyzed alkylation to produce a paraffin.

457 Using organometallic compound catalyst:

This subclass is indented under subclass 46. Subject matter wherein the reaction is catalyzed by a compound which contains both a metal and an organic moiety.

SEE OR SEARCH THIS CLASS, SUBCLASS:

459+, 462+ and 467+, for aromatic alkylation processes using inorganic metal compounds with or without the presence of organic metal-free compounds.

722, for organometallic-catalyzed alkylation to produce a paraffin.

458 Using S-containing catalyst:

This subclass is indented under subclass 446. Subject matter wherein the reaction is catalyzed by sulfur in free or combined form.

459 Using Al halide catalyst:

This subclass is indented under subclass 446. Subject matter wherein the reaction is catalyzed by a fluoride, chloride, bromide, or iodide of aluminum, alone or in combination with other materials.

SEE OR SEARCH THIS CLASS, SUBCLASS:

456, for Al halide catalyzed alkylation to produce an aromatic where the side-chain is restricted to six or more carbon atoms.

727+, for Al halide catalyzed alkylation to produce a paraffin.

460 And additional metal-containing or nonhalide inorganic agent:
This subclass is indented under subclass 459. Subject matter wherein the reaction takes place in the presence of an additional agent which contains metal or which is an inorganic compound not containing halogen.

(1) Note. The additional agent may be water.

461 Complexed, e.g., sludge, etc., or with additional extraneous organic agent:
This subclass is indented under subclass 459. Subject matter wherein the aluminum halide catalyst is described as being in a chemical complex with another material or wherein the reaction takes place in the presence of an organic agent, which may be a solvent, mass-action agent, promoter, etc., which does not contribute atoms to the final product.

(1) Note. The aluminum halide complex may be formed in the reaction of aluminum halide with the hydrocarbon or hydrocarbons present in the process, or the complex may be preformed initially.

SEE OR SEARCH THIS CLASS, SUBCLASS:
312, for plural diverse serial syntheses in which a catalyst complex formed in one reaction is used in another diverse reaction.

462 Using halogen-containing catalyst:
This subclass is indented under subclass 446. Subject matter catalyzed by a material containing fluorine, chlorine, bromine, or iodine in free or combined form.

463 Alumina containing:
This subclass is indented under subclass 462. Subject matter wherein the catalyst also contains aluminum oxide.

(1) Note. The halogen may be added to alumina during the catalyst preparation before calcination, that is, before the alumina is formed; the halogen may also be added to alumina after calcination, or to an alumina-containing catalyst, e.g., a zeolite, during its fabrication; to a final catalyst composite, or in a subsequent activation treatment to enhance the properties of the catalyst in the process.

464 HF:
This subclass is indented under subclass 462. Subject matter wherein the catalyst is hydrogen fluoride alone or in a composition with other materials.

SEE OR SEARCH THIS CLASS, SUBCLASS:
456, for a process of introducing a side-chain of more than five carbon atoms to the ring wherein hydrogen fluoride is used as the catalyst.
723+, for a process wherein two nonring molecules are joined together, e.g., alkylation, etc., which also utilizes a hydrogen fluoride catalyst.

465 B trifluoride in a complex or with additional nonhydrocarbon agent:
This subclass is indented under subclass 462. Subject matter in which the catalyst is a complex of boron trifluoride or a mixture of boron trifluoride with a material containing atoms other than only carbon and hydrogen.

(1) Note. The complex may be inorganic, e.g., $BF_3.H_2O$, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
464, for an aromatic alkylation process utilizing HF with an additional effective agent which may contain, boron, e.g., $HF+BF_3$, etc.

466 Using P-containing catalyst:
This subclass is indented under subclass 446. Subject matter wherein the reaction is catalyzed by phosphorus in free or combined form.

467 Using metal, metal oxide, or hydroxide catalyst:
This subclass is indented under subclass 466. Subject matter catalyzed by a material containing free metal, an oxide of a metal, or a hydroxide of a metal.

468 Noncrystalline, and containing Al and Si:
This subclass is indented under subclass 467. Subject matter wherein the catalyst is amorphous and contains both aluminum and silicon.

469 From nonhydrocarbon feed:
This subclass is indented under subclass 400. Subject matter wherein a reactant which contributes atoms to the final product contains elements other than carbon and hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
408, for an aromatic synthesis process involving a nonhydrocarbon feed and ring formation from a nonring moiety, e.g., cyclic polymerization of benzophenone to produce 1,3,5-triphenyl benzene, etc.

470 By alkyl or aryl transfer between molecules, e.g., disproportionation, etc.:
This subclass is indented under subclass 400. Subject matter wherein an alkyl or aryl moiety of a molecule is transferred to another molecule.

(1) Note. Patents are classified herein on the basis of the net result of the process, regardless of the mechanism involved, that is, the process may proceed by dimerization and cracking, as well as by free-radical transfer.

SEE OR SEARCH THIS CLASS, SUBCLASS:
257, 433, 440, 616, and 656, for disproportionation reactions involving the transfer of hydrogen between hydrocarbon molecules or hydrocarbyl moieties.
446+, and 709+, for condensation of two entire molecules or hydrocarbyl moieties to give an alkylated product.
477, 671 and 734, for a process wherein an alkyl attached to one carbon of a molecule is shifted to another carbon of the same molecule.
643+, and 708, for alkyl or alkenyl transfer processes resulting in unsaturated and saturated products, respectively.

471 Product is polycyclic, of increased side-chain length, or a specific position polyalkyl benzene isomer:
This subclass is indented under subclass 470. Subject matter wherein the product has more than one ring or in which the alkyl group removed from one hydrocarbon molecule is attached to a side-chain already on a ring of another molecule to give an aromatic product with a side-chain containing more carbon atoms than a feedstock side-chain, or in which the process is directed to maximize the production of a claimed isomer having alkyl groups in specific positions on a benzene ring, e.g., mesitylene, metaxylene, etc.

(1) Note. Only one ring of a polycyclic compound needs to be aromatic for placement in this subclass.

(2) Note. Where the process includes a step of removing or recovering a specific material substantially free from its isomers, it can be assumed that the process is directed to maximizing the production of the isomer removed or recovered.

(3) Note. Where the desired product has no aromatic position isomer, e.g., benzene, toluene, ethylbenzene, etc., the patent is not classified here.

472 Using Al or B halide catalyst:
This subclass is indented under subclass 471. Subject matter wherein the synthesis takes place in the presence of an aluminum halide or a boron halide.

SEE OR SEARCH THIS CLASS, SUBCLASS:
473, and 474, for averaging and other transalkylation processes, respectively, using a halogen-containing catalyst.

473 Meta- or 1,3,5-alkyl benzene:
This subclass is indented under subclass 472. Subject matter in which the product is a meta-alkyl benzene, e.g., 1,3-diethyl benzene, etc., or a 1,3,5-trialkyl benzene, e.g., mesitylene, etc.

(1) Note. Tetraalkylbenzenes, etc., are not subject matter for this subclass.

474 Plural compounds of different weight become midweight compound, i.e., averaging:

Subject matter under 470 wherein two or more compounds fed to the reaction, each compound differing from the other in carbon content, are converted to a hydrocarbon compound of carbon content less than one compound and greater than the other, for example, conversion of a mixture of xylene and benzene to toluene.

475 Using crystalline aluminosilicate catalyst:

This subclass is indented under subclass 470. Subject matter wherein the catalyst is a solid compound containing aluminum, silicon, and oxygen atoms in an ordered spatial pattern or arrangement, e.g., a zeolite, etc., and which may be of natural or synthetic origin.

476 By ring opening, removal, degradation, or shift on chain or other ring:

This subclass is indented under subclass 400. Subject matter wherein the product has fewer rings than the feedstock or a ring attached to a multicarbon alkyl moiety or another ring becomes attached to a carbon of the moiety or ring different from the carbon to which attached in the feedstock.

SEE OR SEARCH THIS CLASS, SUBCLASS:

439, for a similar process in which the resulting product has an unsaturated chain moiety.

477 By isomerization:

This subclass is indented under subclass 400. Subject matter wherein the synthesis involves changing the molecular structure of the feed material without a change in its carbon or hydrogen content.

(1) Note. The isomerization may result in movement of a component, e.g., an alkyl side-chain, etc., to a different position on a ring of an aromatic, the rearrangement of carbon atoms within a side-chain, or the removal of a carbon atom from a side-chain to the ring, e.g., conversion of ethylbenzene to xylene, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

404, for an isomerization process which involves ring expansion or contraction.

407, for an isomerization process which involves forming a ring from a non-ring moiety.

471+, for a process wherein aromatic isomerization takes place simultaneously with alkyl transfer.

476, for an isomerization process which involves opening a ring of a polycyclic feedstock or moving a ring from one carbon to another of a "side" chain or second ring.

478 With plural separation steps:

This subclass is indented under subclass 477. Subject matter in which more than one separation step is performed.

(1) Note. A separation step before isomerization combined with a separation step after isomerization is considered plural steps.

SEE OR SEARCH THIS CLASS, SUBCLASS:

804+, for an aromatic recovery process employing plural diverse serial separations.

815, for a hydrocarbon recovery process employing serial crystallization procedures.

822, for a hydrocarbon recovery process employing plural serial sorption steps.

479 Including a crystallization step:

This subclass is indented under subclass 478. Subject matter wherein one or more of the plural separation steps involves chilling a mixture to solidify a component of the mixture.

SEE OR SEARCH THIS CLASS, SUBCLASS:

812+, for solidification processes, per se, specific to the separation or purification of hydrocarbons.

SEE OR SEARCH CLASS:

62, Refrigeration, subclasses 532+ for fractional crystallization processes of general applicability.

480 Using metal oxide-or sulfide-containing catalyst:

This subclass is indented under subclass 477. Subject matter catalyzed by an inorganic compound which contains a metal and oxygen or sulfur.

481 Crystalline aluminosilicate:

This subclass is indented under subclass 480. Subject matter wherein the compound contains aluminum, silicon, and oxygen atoms in an ordered spatial pattern or arrangement, e.g., a zeolite, etc., and which may be of natural or synthetic origin.

482 Pt-group metal containing:

This subclass is indented under subclass 480. Subject matter catalyzed by ruthenium, rhodium, palladium, osmium, iridium, or platinum in free or combined form.

483 By dealkylation:

This subclass is indented under subclass 400. Subject matter wherein a side-chain is wholly or partially removed from the ring of an aromatic, e.g., the demethylation of ethylbenzene or xylene to form toluene and/or benzene, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

404+, for a process wherein a ring component at the end of the process has more carbons in the ring or less carbons in the ring than at the start of the process.

470, for a process wherein an alkyl group removed from one hydrocarbon molecule is attached to another molecule, i.e., dealkylation using a hydrocarbon acceptor for the removed alkyl moiety.

476+, for a process wherein a ring of a polycyclic aromatic is opened with or without partial or complete removal of carbon atoms from the resulting side-chain.

800+, for a process wherein an aromatic compound feedstock is purified by cracking the nonaromatic impurities.

484 Polycyclic:

This subclass is indented under subclass 483. Subject matter in which the feedstock is an alkylated aromatic hydrocarbon having more than one ring, e.g., naphthalene, tetralin, indane, fluorene, diphenyl, phenycyclohexane, phenylcyclopentene, diphenylmethane, etc.

(1) Note. A process which employs a hydrogen donor compound, rather than elemental hydrogen, is classified in this subclass, rather than in subclass 485.

SEE OR SEARCH THIS CLASS, SUBCLASS:

257, for a process wherein a hydrocarbon compound supplies hydrogen for saturating an unsaturated bond of another hydrocarbon molecule, the latter being recovered as a product.

485 Using catalyst and H:

This subclass is indented under subclass 484. Subject matter wherein the process takes place in the presence of added elemental hydrogen and a catalyst.

(1) Note. The catalyst need not be a solid; therefore, classification is appropriate in this subclass for many processes which are termed “thermal” or “noncatalytic” but which in actuality use an agent other than the reactants to further the reaction by more than merely supplying heat.

486 Using extraneous agent in reaction zone, e.g., catalyst, etc.:

This subclass is indented under subclass 483. Subject matter wherein part or all of the synthesis takes place in the presence of an added material, whether called a catalyst, a diluent, a heat carrier, etc., or not, which speeds a desired reaction or retards in undesired reaction and which does not supply a significant number of atoms of material to the final product.

(1) Note. Water and hydrogen are considered reactants in the processes of this subclass and not extraneous agents.

487 And steam:

This subclass is indented under subclass 486. Subject matter wherein the reaction takes place in the presence of steam, water vapor, etc.

SEE OR SEARCH CLASS:

48, Gas: Heating and Illuminating, subclass 214 for a similar process in which a hydrogen-containing gas mixture, suitable for burning, is the desired product.

252, Compositions, subclass 373 for a similar process in which a synthesis gas containing hydrogen and carbon oxide is the desired product.

423, Chemistry of Inorganic Compounds, subclasses 652+ for a similar process in which hydrogen is the desired product.

488 And hydrogen:

This subclass is indented under subclass 486. Subject matter wherein the reaction takes place in the presence of elemental hydrogen.

489 Transition metal-containing catalyst:

This subclass is indented under subclass 488. Subject matter catalyzed by a material containing, in free or combined form, a metal in which an inner electron shell, rather than an outer shell, is partially filled.

(1) Note. In the periodic table transition metals include elements 21 - 30 (scandium - zinc), 39 - 48 (yttrium - cadmium), 57 - 80 (lanthanum - mercury), and 89 - 103 (actinium - lawrencium).

500 UNSATURATED COMPOUND SYNTHESIS:

This subclass is indented under the class definition. Subject matter in which a hydrocarbon molecule is produced which has no ring configuration and is less than saturated with hydrogen, that is, is having less hydrogen than the formula $C_{nH2n}+2$, which molecule was not present as the same structurally or empirically identical molecule at the beginning of the process.

SEE OR SEARCH CLASS:

204, Chemistry: Electrical and Wave Energy, subclasses 157.15+ for chemical synthesis of a hydrocarbon compound by utilizing wave energy and subclasses 168+ for chemical synthesis of a hydrocarbon compound by utilizing an electrostatic field or electrical discharge.

520, Synthetic Resins or Natural Rubbers, for processes of manufacturing synthetic resins which may be hydrocarbons.

501 With measuring, sensing, testing, or synthesis operation control responsive to diverse condition:

This subclass is indented under subclass 500. Subject matter wherein the process involves a definitely recited step of measuring, analyzing, etc., a condition or parameter of the process or in which a condition of the synthesis operation, e.g., temperature etc., is adjusted in accordance with a different aspect of the synthesis, e.g., strength of catalyst, etc.

(1) Note. A process in which the same operating condition is controlled, e.g., adding heat to a reaction in response to a temperature drop in the reaction zone, is not included in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

401, and 701, for similar procedures employed in the synthesis of aromatic and saturated hydrocarbon compounds, respectively.

956, for a collection of patents disclosing such procedures in other aspects of hydrocarbon processing.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for processes and apparatus for making a measurement or test of any kind not claimed in combination with synthesis of an organic compound and not elsewhere classifiable; and the main class definition thereof for the identification of other classes concerned with testing.

436, Chemistry: Analytical and Immunological Testing, subclasses 1+ for a test or measurement associated with a chemical reaction not elsewhere classifiable, or analysis, by chemical methods, of organic material.

502 By addition of entire unsaturated molecules, e.g., polymerization, etc.:

This subclass is indented under subclass 500. Subject matter wherein at least two hydrocarbon molecules, each having a double or triple bond, join to form an unsaturated compound having a molecular weight which equals the total of the molecular weight of the additive (monomer) molecules.

(1) Note. Where a reaction is stated to be "polymerization", "dimerization", etc., and all the reactants are unsaturated, it is assumed that the product is unsaturated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

361+, for addition of entire cyclic molecules to form a polycyclic nonaromatic product.

366, for cyclic polymerization of an alkadiene to produce an alicyclic compound.

406, dimerization of a vinyl aromatic compound.

415+, for cyclic polymerization of an acyclic material to produce an aromatic compound.

422+, for condensation of entire cyclic molecules, including reactions similar to those herein (subclasses 502+) where an aromatic ring is a "passive" substituent on an unsaturated chain, e.g., polymerization of styrene, etc.

SEE OR SEARCH CLASS:

208, Mineral Oils: Processes and Products, subclass 46 for processes of polymerizing or condensing mineral oils; subclass 20 for petroleum wax products; and subclasses 24+ for treatment of mineral paraffin wax.

520, Synthetic Resins or Natural Rubbers, for a polymerization process which results in a solid polymer, especially Class 526 for the polymerization of ethylenically unsaturated monomers. Where a patent has claims to production of both solid and nonsolid polymers or has claims only to a polymerization process which, according to the disclosure, may produce a solid polymer as a desired product, the patent is classified in the Class 520 series and cross-referenced here (subclasses 502+) when appropriate.

503 With heat conservation or using apparatus of recited composition:

This subclass is indented under subclass 502. Subject matter wherein heat generated in the process, e.g., by reaction, catalyst regeneration, adsorbed by quenching reactants, etc., is put to use in the process or in which the chemical composition of apparatus used in the process is specified.

(1) Note. Patents placed herein are not cross-referenced to subclasses 910+ and 920 unless the processes therein are disclosed as applicable to other than polymerization processes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

402, 535, 602, and 634, for aromatic synthesis, alkyne synthesis, diolefin synthesis, and saturated compound synthesis, respectively, using similar techniques.

910+, and 920, for collections of patents wherein similar techniques are employed in other syntheses.

950, for a collection of patents disclosing prevention of solid deposits on apparatus by forming a permanent or temporary protective coating of named composition of surfaces of the apparatus.

504 With specified procedure for recycle of nonhydrocarbon:

This subclass is indented under subclass 502. Subject matter wherein a procedure is recited for getting catalyst or other nonhydrocarbon material which has been removed from a reaction back into the reaction, which procedure goes beyond mere nominal "recycling", "regenerating", etc.

505 Triple-bond product:
This subclass is indented under subclass 502. Subject matter wherein the product contains acetylenic unsaturation.

SEE OR SEARCH THIS CLASS, SUBCLASS:
534+, for synthesis of triple-bond materials by phenomena other than polymerization.

506 Poly-double-bond product:
This subclass is indented under subclass 502. Subject matter wherein the product contains more than one olefinically unsaturated bond.

(1) Note. Where a diene is codimerized with a monoene, it is assumed that the product has two double bonds.

SEE OR SEARCH THIS CLASS, SUBCLASS:
600, and 601+, for synthesis of polyolefins by phenomena other than polymerization.

507 More than two double bonds, e.g., diene polymerization, etc.:
This subclass is indented under subclass 506. Subject matter wherein the product has three or more ethylenically unsaturated sites in its molecule.

(1) Note. An addition product is presumed to have three or more double bonds when all the monomer molecules have two or more double bonds.

(2) Note. The products of processes of this subclass are often of utility as synthetic drying oils.

SEE OR SEARCH THIS CLASS, SUBCLASS:
945, for a collection of patents disclosing drying-oil products. Patents classified herein are not cross-referenced to subclass 945.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclass 1 for a synthetic drying oil derived from a mineral oil.

508 Of definite molecular weight, e.g., dimer, etc.:
This subclass is indented under subclass 507. Subject matter wherein the product can be described by an empirical formula having only invariable subscripts.

SEE OR SEARCH THIS CLASS, SUBCLASS:
366+, for a diene dimerization process which results in the production of a desired alicyclic product.

509 Using P-containing catalyst:
This subclass is indented under subclass 506. Subject matter catalyzed by a material containing phosphorus in free or combined form.

(1) Note. The product has two double bonds as, for example, a codimer of butene and butadiene, etc.

510 Definite molecular weight product, e.g., dimer, etc.:
This subclass is indented under subclass 502. Subject matter wherein a monoolefin product can be described by an empirical formula having only invariable subscripts.

(1) Note. The desired product may be a mixture of isomers or a restricted mixture of related compounds, e.g., a dimertrimer mixture.

SEE OR SEARCH THIS CLASS, SUBCLASS:
520+, for a catalytic polymerization process where there is no intent to maximize the production of a material having a definite molecular weight.

511 Using catalyst containing metal bonded to or complexed with C, C-containing compound, or H:
This subclass is indented under subclass 510. Subject matter wherein the catalyst contains a metal bonded to or complexed with carbon, a carbon compound, or hydrogen, e.g., alkali metal-carbon complexes, metal hydrides, metal alkyls, metal carbonyls, etc.

512 Al- and transition metal-containing:
This subclass is indented under subclass 511. Subject matter wherein the catalyst contains aluminum and a transition metal, either metal or both metals appearing in a hydride, carbon compound, or complex.

(1) Note. A transition metal is one in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table transition metals include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

513 And N-, P-, or S-containing:
This subclass is indented under subclass 512. Subject matter wherein the catalyst additionally contains a compound of nitrogen, phosphorus, or sulfur.

514 Using P-containing catalyst:
This subclass is indented under subclass 510. Subject matter catalyzed by a material which contains phosphorus in free or combined form.

515 Using S-containing catalyst:
This subclass is indented under subclass 510. Subject matter catalyzed by a material which contains sulfur in free or combined form.

516 Using alkali metal-containing catalyst:
This subclass is indented under subclass 510. Subject matter catalyzed by a material which contains lithium, sodium, potassium, rubidium, cesium, or francium in free or combined form.

(1) Note. A crystalline aluminosilicate catalyst, whether natural or synthetically prepared, will usually contain alkali metal unless such metal component is specifically removed.

517 Plural serial polymerization stages:
This subclass is indented under subclass 502. Subject matter wherein the effluent of a polymerization is sent to a further polymerization stage.

(1) Note. A mere recycle of unpolymerized portions of an effluent to the same polymerization zone does not indicate classification in this subclass.

518 With preliminary treatment of feed:
This subclass is indented under subclass 502. Subject matter wherein the feed to polymerization is the effluent from a nonsynthesis treatment, usually a purification treatment, heating treatment, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
503, for an olefin polymerization process in which the feed pretreatment is heating and the heat is that abstracted from reaction products of the process.

SEE OR SEARCH CLASS:
526, Synthetic Resins or Natural Rubbers, subclass 77 for a process in which an olefin monomer is purified preliminary to its polymerization into a solid polymer.

519 Removal of hydrocarbon fraction:
This subclass is indented under subclass 518. Subject matter wherein the preliminary treatment is such as to remove from the feedstock a type of hydrocarbon undesired in the polymerization reaction, e.g., a hydrocarbon of too low or too high molecular weight, of undesired molecular structure, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
517, for such a process in which the removal mechanism is olefin polymerization.

SEE OR SEARCH CLASS:
62, Refrigeration, subclasses 606+ and 617+ for extracting, per se, of a component from a mixture of gases by liquefaction and separation.

520 Using extraneous nonhydrocarbon agent, e.g., catalyst, etc.:
This subclass is indented under subclass 502. Subject matter wherein part or all of the synthesis takes place in the presence of a material which chemically effects the synthesis by promoting, retarding, etc., but which does not form a part of the desired product and is, at least in theory, separable from the desired reac-

tion products. The agent may be a catalyst, solvent, etc., and is inorganic or is an organic material containing other elements than carbon and hydrogen.

(1) Note. Where the claims recite merely a "polymerization" process but there appears to be a clear intent to maximize the production of a particular compound, e.g., a dimer, etc., the patent is placed in subclasses 510+ and cross-referenced here (subclasses 520+) when appropriate.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403, 503, 537, 636, and 920, for hydrocarbon syntheses which employ apparatus of recited composition, in some cases the composition (e.g., a reactor lining) being or containing a catalyst agent.

507, for a process wherein polyolefins are reacted in the presence of a catalyst.

510+, for a process wherein olefins are reacted in the presence of a catalyst to produce definite molecular weight products.

521 Hydride or organic compound or complex containing alkaline-, B-, or Zn-group material:

This subclass is indented under subclass 520. Subject matter catalyzed by a material containing lithium, sodium, potassium, rubidium, beryllium, magnesium, calcium, strontium, barium, boron, aluminum, gallium, indium, thallium, zinc, cadmium, or mercury in the form of a hydride, an organic compound, or an inorganic compound complexed with an organic material.

522 Al trialkyl:

This subclass is indented under subclass 521. Subject matter wherein the catalyst includes an alkyl aluminum compound having three alkyl moieties for each atom of aluminum therein, e.g., triethylaluminum, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

328, for a process for producing an olefin in which a step of removing an olefin product from an aluminum alkyl "growth" product compound, by displacement with a different olefin after the "growth" step, is positively recited.

523 Transition metal-containing:

This subclass is indented under subclass 521. Subject matter wherein the catalyst contains one or more transition metals in free or combined form.

(1) Note. A transition metal is one in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table transition metals include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

524 Ti:

This subclass is indented under subclass 523. Subject matter wherein the catalyst contains titanium in free or combined form.

525 B-containing catalyst:

This subclass is indented under subclass 520. Subject matter catalyzed by a material containing boron in free or combined form.

SEE OR SEARCH THIS CLASS, SUBCLASS:

521+, for a similar process catalyzed by a material having a boron component complexed with an organic material.

526 S-containing catalyst:

This subclass is indented under subclass 520. Subject matter catalyzed by a material containing sulfur in free or combined form.

527 N- or P-containing catalyst:

This subclass is indented under subclass 520. Subject matter catalyzed by a material containing nitrogen or phosphorus in free or combined form.

528 Metal phosphate:

This subclass is indented under subclass 527. Subject matter wherein the phosphorus compound is a metal phosphate.

529 P compound on solid carrier, e.g., "solid phosphoric acid", etc.:
This subclass is indented under subclass 527. Subject matter wherein a phosphorus compound is supported on a solid carrier.

(1) Note. The designation of the catalyst as "solid phosphoric acid" is sufficient for placement in this subclass.

530 Catalyst containing inorganic metal:
This subclass is indented under subclass 520. Subject matter catalyzed by a material containing elemental metal or a metal compound devoid of organic moieties.

531 Group VIII metal:
This subclass is indented under subclass 530. Subject matter wherein the catalyst contains iron, cobalt, nickel, ruthenium, rhodium, palladium, osmium, iridium, or platinum in free or combined form.

532 Al:
This subclass is indented under subclass 530. Subject matter wherein the catalyst contains aluminum.

SEE OR SEARCH THIS CLASS, SUBCLASS:
521+, for an olefin-yielding polymerization process which uses as a catalyst a complex of an aluminum halide with an organic compound, e.g., alkylation sludge.

533 Al oxide, e.g., aluminosilicate, etc.:
This subclass is indented under subclass 532. Subject matter catalyzed by a material containing an inorganic compound of aluminum and oxygen.

(1) Note. The compound may contain only aluminum and oxygen, or other materials as well, e.g., an aluminosilicate, etc.

534 Triple-bond product:
This subclass is indented under subclass 500. Subject matter wherein the unsaturated hydrocarbon product is one having acetylenic unsaturation.

(1) Note. This subclass (534) is the locus for patents wherein an acetylenic product is made from an inorganic material.

SEE OR SEARCH THIS CLASS, SUBCLASS:
505, for production of an acetylenically unsaturated material by polymerization.
943, for a collection of patents disclosing the manufacture of hydrocarbons from inorganic materials.

SEE OR SEARCH CLASS:
48, Gas: Heating and Illuminating, appropriate subclasses for methods and apparatus for manufacture of a fuel gas mixture containing acetylene and other components.

535 With heat conservation or using solid inert heat carrier, e.g., regenerative furnace, etc.:
This subclass is indented under subclass 534. Subject matter wherein heat generated in the process, e.g., by reaction, catalyst regeneration, adsorded by quenching reactants, etc., is put to use in the process or wherein an inert solid material is employed to supply heat to the synthesis reaction or to absorb heat from the synthesis reaction.

(1) Note. Patents placed herein are not cross-referenced to subclasses 910+.

SEE OR SEARCH THIS CLASS, SUBCLASS:
402, 503, 602, and 634, for aromatic synthesis, olefin condensation, diolefin synthesis, and saturated compound synthesis, respectively, using similar techniques.
910+, for a collection of patents where similar techniques are employed in other syntheses.

536 With carrier movement through reaction zone:
This subclass is indented under subclass 535. Subject matter wherein the heat carrier, usually in particulate form, e.g., pebbles, etc., passes into and out of the reaction zone during the reaction.

537 Using apparatus of recited composition:
This subclass is indented under subclass 534. Subject matter wherein the process recites the composition of apparatus employed in the process, e.g., a stainless steel reactor wall, a refractory ceramic baffle, etc.

(1) Note. Materials which move through or are readily removable from the apparatus, e.g., catalyst beds, are not considered part of the apparatus for this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:
403, 503 and 537, for aromatic synthesis, olefin polymerization, and monoolefin synthesis, respectively, using apparatus of recited composition.
920, for a collection of patents using such apparatus in other processes.
921+, for a collection of patents in which the effectiveness of a process depends upon the use of apparatus having a defined structure configuration, independent of the composition of the structure.

538 From organic nontriple-bond feed:
This subclass is indented under subclass 534. Subject matter wherein the carbon content of the product is derived from a starting material which comprises an organic compound which is without acetylenic unsaturation.

(1) Note. Where a feedstock is described merely as a "hydrocarbon", it is assumed that the feedstock is nontriple-bond.

539 By thermal conversion of hydrocarbon, i.e., thermolysis:
This subclass is indented under subclass 538. Subject matter wherein the conversion is effected without a catalyst or hydrogen acceptor by application of heat. The feed may have higher, lower, or the same number of carbon atoms as the product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
648+, for a pyrolysis process similar to those included herein, where triple-bond materials may be produced but are not the desired product.
943, for a collection of patents wherein methane or an inorganic material is a starting material for synthesis of hydrocarbons. Patents classified herein are <u>not</u> cross-referenced to subclass 943.

SEE OR SEARCH CLASS:
48, Gas: Heating and Illuminating, subclasses 216+ for methods of generating acetylene in admixture with other gases.

540 By partial combustion of hydrocarbons:
This subclass is indented under subclass 538. Subject matter wherein a hydrocarbon is converted by reaction with oxygen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
621+, and 656+, for dehydrogenation processes which employ an elemental oxygen hydrogen acceptor to produce diolefins and monoolefins, respectively.

541 Using extraneous nonreactant, e.g., diluent, catalyst, etc.:
This subclass is indented under subclass 540. Subject matter wherein a material in addition to oxygen and the hydrocarbon which supplies the atoms recovered in the product is introduced into the reaction zone to influence the reaction. The additional material may be a fuel, diluent, inhibitor, catalyst, etc.

600 Product having more than two double bonds:
This subclass is indented under subclass 500. Subject matter wherein the synthesis operation produces a compound having more than two olefinically unsaturated bonds in the molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:
507+, for a polymerization process having such a product.

601 Diolefin product:
This subclass is indented under subclass 500. Subject matter wherein the synthesis operation produces a compound having two olefinically unsaturated bonds in the molecule.

(1) Note. This subclass (601) is the locus for conversion of a triple bond to two double bonds, e.g., methyl acetylene to allene, etc., and for double bond shift isomerization to form a diolefin.

SEE OR SEARCH THIS CLASS, SUBCLASS:
377+, and 664+, for the synthesis, by double bond shift, of cycloolefins and monoolefins, respectively.

602 With heat conservation or using solid inert heat carrier, e.g., regenerative furnace, etc.:
This subclass is indented under subclass 601. Subject matter wherein heat generated in the process, e.g., by reaction, catalyst regeneration, adsorbed by quenching reactants, etc., is put to use in the process or wherein an inert solid material is employed to supply heat to the synthesis reaction or to absorb heat from the synthesis reaction.

(1) Note. Patents placed herein are not cross referenced to subclass 910.

SEE OR SEARCH THIS CLASS, SUBCLASS:
402, 503, 535, and 634, for aromatic synthesis, olefin condensation, alkyne synthesis, and saturated compound syntheses, respectively, using similar techniques.
910, for a collection of patents where similar techniques are employed in other syntheses.

603 From nonhydrocarbon feed:
This subclass is indented under subclass 601. Subject matter wherein a feedstock compound, which furnished carbon atoms appearing in the final product, contains atoms other than carbon and hydrogen.

604 Heterocyclic:
This subclass is indented under subclass 603. Subject matter wherein the nonhydrocarbon feedstock is a cyclic material containing an atom other than carbon in the ring, e.g., dioxane.

605 Using P-containing catalyst:
This subclass is indented under subclass 604. Subject matter catalyzed by a material containing phosphorus in free or combined form.

606 O-containing:
This subclass is indented under subclass 603. Subject matter wherein the nonhydrocarbon contains oxygen.

607 Plural O-containing organic compounds:
This subclass is indented under subclass 606. Subject matter wherein at least two organic compounds of the feedstock, each compound containing oxygen, contribute carbon atoms to the final product.

608 With unsaturated hydrocarbon in feed:
This subclass is indented under subclass 606. Subject matter wherein the feedstock to the synthesis also contains a hydrocarbon having olefinic or acetylenic unsaturation.

SEE OR SEARCH THIS CLASS, SUBCLASS:
257, 433, 440+, 616, and 656+, for hydrogen-exchange disproportionation processes.

609 Alcohol:
This subclass is indented under subclass 606. Subject matter wherein the oxygen-containing compound has a hydroxyl (-OH) group.

610 Diol:
This subclass is indented under subclass 609. Subject matter having two -C-O-H groups or a H-O-C-O-H group.

611 Using P-containing catalyst:
This subclass is indented under subclass 610. Subject matter catalyzed by a material containing phosphorus in free or combined form.

612 Halogen-containing feed using extraneous nonhydrocarbon agent:
This subclass is indented under subclass 603. Subject matter wherein a feedstock compound contains fluorine, chlorine, bromine, or iodine and part or all of the synthesis takes place in the presence of a material which chemically affects the synthesis by promoting, retarding, etc., but which does not form a part of the desired product and is, at least in theory, separable from the desired reaction products. The agent may be a catalyst, solvent, etc., and is inorganic or is an organic material containing other elements than carbon and hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
403, 503, 537, 636, and 920, for processes which employ apparatus of recited compositions, in some cases the composition (e.g., a reactor lining) being or containing a catalytic agent.

613 By C content reduction, e.g., cracking, etc.:
This subclass is indented under subclass 601. Subject matter wherein the product diolefin molecule contains fewer carbon atoms than a feedstock hydrocarbon molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:
476+, 539, 648+, and 752, for cracking processes which yield aromatic, acetylenic, monoolefinic and paraffinic hydrocarbons, respectively.

614 Isoprene product, per se:
This subclass is indented under subclass 613. Subject matter wherein the product recovered is isoprene, i.e.,

(1) Note this subclass is the locus for the production of isoprene by depolymerization of terpenes.

615 Butadiene product, per se:
This subclass is indented under subclass 613. Subject matter wherein the product recovered is butadiene, i.e., H_2 C=CH-CH=CH_2.

616 By dehydrogenation:
This subclass is indented under subclass 601. Subject matter wherein hydrogen is removed from a feedstock to synthesize the diolefin product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
257, for a process where a hydrocarbon is dehydrogenated by transfer of hydrogen to another hydrocarbon, the acceptor compound being a material desired for recovery.
430, 440+ and 654+, for dehydrogenation processes for the production of other types of hydrocarbon.
613, for a diolefin synthesis process which includes carbon removal as well as hydrogen removal.

617 Using nonhydrocarbon acceptor:
This subclass is indented under subclass 616. Subject matter wherein the process employs a material which reacts with the hydrogen removed from a feed molecule thereby synthesizing a compound containing the removed hydrogen and different from the added material.

(1) Note. These processes sometimes use a solid acceptor material which, after it is no longer of satisfactory activity, may be regenerated. While this acceptor material may sometimes be called a catalyst it is distinguishable from a true catalyst by the stoichiometric proportions used and by the fact the hydrogen is removed from the process as a compound containing some or all of the atoms brought into the process by the acceptor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
900, for a collection of patents which disclose processing of a used hydrogen acceptor to put it into condition for further use in dehydrogenation of a hydrocarbon.

618 Halogen-containing acceptor with elemental O:
This subclass is indented under subclass 617. Subject matter wherein the acceptor is halogen or a halogen-containing compound and elemental oxygen is included in the dehydrogenation reaction mixture.

619 Halogen is I only:
This subclass is indented under subclass 618. Subject matter wherein the halogen material used is restricted to iodine.

620 Halogen is C1 only:
This subclass is indented under subclass 618. Subject matter in which the halogen material used is restricted to chlorine.

621 Elemental O acceptor:
This subclass is indented under subclass 617. Subject matter wherein the acceptor is oxygen which enters the process in free or uncombined form.

(1) Note. A process which described as "oxidative dehydrogenation" is presumed to use an elemental oxygen acceptor.

622 With P containing extraneous agent:
This subclass is indented under subclass 621. Subject matter wherein the process employs an extraneous agent, that is, a material which does not supply atoms to the final product or by-product, which contains phosphorus in free or combined form.

623 Sn-containing:
This subclass is indented under subclass 622. Subject matter in which the agent(s) include(s) tin.

624 With metal oxide or hydroxide extraneous agent:
This subclass is indented under subclass 621. Subject matter wherein the process employs an extraneous agent, that is, a material which does not supply atoms to the final product or by-product, which contains metal in the form of an oxide or hydroxide.

625 Ferrite:
This subclass is indented under subclass 624. Subject matter in which the agent is a compound of trivalent iron oxide with a basic oxide.

(1) Note. Ferrites are insoluble substances of spinel type which are prepared synthetically by fusion without water or occur in nature. The term "ferrite" is also applied to certain salts which contain tetra- and quinque-position iron, e.g., $BaFeO_3$, which is a black powder formed when barium and ferric hydroxides are heated together in oxygen. See Miall et al., A New Dictionary Of Chemistry, 4th Edition, p. 239, Longman Group Limited, 1968.

626 Oxide of As, Bi, or Sb:
This subclass is indented under subclass 624. Subject matter wherein a metal oxide is arsenic oxide, antimony oxide, or bismuth oxide.

627 Using extraneous nonhydrocarbon agent, e.g., catalyst, etc.:
This subclass is indented under subclass 616. Subject matter wherein part or all of the synthesis takes place in the presence to a material which chemically affects the synthesis by promoting, retarding, etc., but which does not form a part of the desired product and is, at least in theory, separable from the desired reaction products. The agent may be a catalyst, solvent, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
403, 503, 537, 636, and 920, for processes which employ apparatus of recited composition, in some cases the composition (e.g., a reactor lining) being or containing a catalytic agent.

628 Moving catalyst or plural stage:
This subclass is indented under subclass 627. Subject matter wherein the effluent from one dehydrogenation procedure is sent to another, different dehydrogenation procedure or in which a solid material (including fluent solids) is specified as moving during the process, that is, moving within, or into, or out of the reactor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

330, for a process in which the effluent from a dehydrogenation step is sent to a polymerization step.

629 Transition metal oxide or sulfide agent:

This subclass is indented under subclass 627. Subject matter wherein a compound of one or more transition metals with oxygen only or sulfur only is an extraneous agent.

(1) Note. A transition metal is one in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table transition metals include elements 21 through 30 (sandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

630 Cr, Mo, or W:

This subclass is indented under subclass 629. Subject matter wherein a transition metal is chromium, molybdenum, or tungsten.

631 With other transition metal:

This subclass is indented under subclass 630. Subject matter wherein the chromium, molybdenum, and/or tungsten compound is associated with a compound of a transition metal from a group other than Group VI.

632 Metal salt agent:

This subclass is indented under subclass 627. Subject matter in which an agent is an ionizable compound having a metal cation and an anion other than hydroxyl.

633 Plural stage or with specified quench or separation procedure:

This subclass is indented under subclass 616. Subject matter wherein a dehydrogenation reactor effluent material is passed to another dehydrogenation reaction or stage to a temperature reduction stage or to a separation procedure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

330, for a process in which the effluent from a dehydrogenation step is sent to a polymerization step.

654+, for a process of monoolefin synthesis by dehydrogenation, which process may often be equivalent to the first stage of processes contained herein (subclass 633).

634 With heat conservation or using solid or molten inert heat carrier, e.g., regenerative furnace, etc.:

This subclass is indented under subclass 500. Subject matter wherein a synthesis process includes the withdrawal of heat from an exothermic part of the process, e.g., catalyst regeneration, quenching of reaction products, etc., and transfer of this heat to an endothermic part of the process, e.g., feed-stream preheating, dehydrogenation, etc., or in which heat is conveyed to an endothermic part of the process by preheating a solid or melted solid.

SEE OR SEARCH THIS CLASS, SUBCLASS:

402, 602, 616, and 910, for heat conservation in other hydrocarbon syntheses.

635 With carrier movement through reaction zone or use in quenching:

This subclass is indented under subclass 634. Subject matter in which the solid or molten heat carrier enters and exits from the reaction zone during the synthesis reaction or in which the carrier is contacted with a reaction effluent to cool the effluent stream.

636 Using apparatus of recited composition:

This subclass is indented under subclass 500. Subject matter wherein the process recites the composition of apparatus employed in the process, e.g., a stainless steel reactor wall, a refractory ceramic baffle, etc.

(1) Note. Materials which move through or are readily removable from the apparatus, e.g., catalyst beds, are not considered part of the apparatus for this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403, 503 and 537, for aromatic synthesis, olefin polymerization, and alkyne syntheses, respectively, using apparatus of recited composition.

920, for a collection of patents using such apparatus in other processes.

921+, for a collection of patents in which the effectiveness of a process depends upon the use of apparatus having a defined structural configuration, independent of the composition of the structure.

950, for a collection of patents disclosing prevention of solid deposits on apparatus by forming a permanent or temporary protective coating of named composition on surfaces of same.

637 By displacement of hydrocarbon radical by hydrocarbon molecule:

This subclass is indented under subclass 500. Subject matter in which the carbon content of the unsaturated material, which is a product of the process, enters the process as a substituent of a larger molecule from which the substituent is displaced by an entire hydrocarbon molecule which becomes a radical (e.g., Fig. 1 below) diagram.

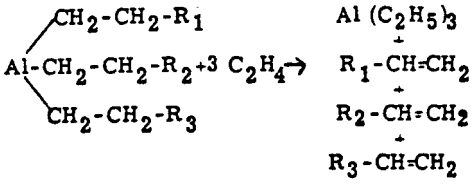


FIGURE 1

SEE OR SEARCH THIS CLASS, SUBCLASS:

328, for a process which includes the synthesis of the substituent, e.g., a "growth" reaction, before displacement.

638 From nonhydrocarbon feed:

This subclass is indented under subclass 500. Subject matter wherein an olefin is produced from a feedstock molecule which contains another element in addition to carbon and hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:

357, 469, 603+, and 733, for the production in general, from nonhydrocarbon feedstocks, of alicyclic, aromatic, diolefin, and paraffin products, respectively.

930+, for collections of patents which include the production of a nonhydrocarbon intermediate.

639 Alcohol, ester, or ether:

This subclass is indented under subclass 638. Subject matter wherein a nonhydrocarbon feedstock molecule is an alcohol, an ether, or an ester.

(1) Note. An acid extract of an olefin which requires "decomposition" for recovery of the olefin usually is an ester.

SEE OR SEARCH THIS CLASS, SUBCLASS:

311, and 710, for synthesis processes, one step of which may be liberation of an olefin from an ester of a catalytic acid.

858+, for a purification process which may involve liberation of an olefin from its sulfate ester.

640 Using metal oxide catalyst:

This subclass is indented under subclass 639. Subject matter wherein a catalyst containing a metal oxide is employed.

641 Halogen-containing:

This subclass is indented under subclass 638. Subject matter wherein a nonhydrocarbon feedstock molecule contains fluorine, chlorine, bromine, or iodine.

642 Using acid, metal oxide, or salt catalyst:

This subclass is indented under subclass 641. Subject matter wherein a catalyst is used which contains acid, metal oxide, or a metal salt.

643 By alkyl transfer, e.g., disproportionation, etc.:
This subclass is indented under subclass 500. Subject matter in which an alkyl or alkenyl moiety of a molecule is transferred to another molecule.

(1) Note. Patents are classified herein on the basis of the net result of the process, regardless of the mechanism involved, that is, the process may proceed by dimerization and cracking, as well as by free-radical transfer.

SEE OR SEARCH THIS CLASS, SUBCLASS:
368, 433, 440, 616, and 656, for disproportionation reactions involving the transfer of hydrogen between hydrocarbon molecules or hydrocarbyl moieties.
446+, and 709+, for the condensation of two entire molecules or hydrocarbyl moieties to give an alkylated product.
477, 671 and 734, for a process wherein an alkyl attached to one carbon of a molecule is shifted to another carbon of the same molecule.
470+, and 708, for alkyl or alkenyl transfer processes resulting in aromatic and saturated products, respectively.

644 Plural stage or averaging:
This subclass is indented under subclass 643. Subject matter in which the effluent from an alkyl transfer reaction or stage is sent to another alkyl transfer reaction or stage or in which olefins of at least two different carbon contents are reacted to produce olefin material having a carbon content numbering between the carbon content numbers of the starting olefins.

SEE OR SEARCH THIS CLASS, SUBCLASS:
474, for averaging processes applied to aromatic hydrocarbons.

645 Using organic extraneous agent:
This subclass is indented under subclass 643. Subject matter wherein a part or all of the synthesis takes place in the presence of an organic material which chemically affects the synthesis by promoting, retarding, etc., but which does not form a part of the desired product and is, at least in theory, separable from the desired reaction products. The agent may be a catalyst, solvent, etc.

646 Using catalyst containing Mo, W, or Re and another transition metal:
This subclass is indented under subclass 643. Subject matter wherein the reaction employs as a catalyst a material containing molybdenum, tungsten, or rhenium and in addition a transition metal other than these three.

(1) Note. A transition metal is one in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table transition metals include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

647 Using Re-containing catalyst:
This subclass is indented under subclass 643. Subject matter wherein the reaction employs a catalyst containing rhenium and free from other transition metals.

648 By C content reduction, e.g., cracking, etc.:
This subclass is indented under subclass 500. Subject matter wherein the feed to the reaction contains more carbon atoms in its molecule than the product contains.

SEE OR SEARCH THIS CLASS, SUBCLASS:
439, and 476, for cracking processes which produce an aromatic product.
500, for cracking processes which produce a triple-bond product.
752, for cracking processes which produce a paraffin product.

649 Isobutylene product, per se:
This subclass is indented under subclass 648. Subject matter wherein isobutylene (H_3C-CH_3) is produced for example, by depolymerization of polybutylene.

(1) Note. The expression, “per se”, is meant to include product mixtures which con-

tain isobutylene as a desired product and to exclude derivatives of isobutylene.

650 Ethylene product, per se:
This subclass is indented under subclass 648. Subject matter wherein ethylene is produced.

(1) Note. The expression, "per se", is meant to include product mixtures which contain ethylene as a desired product and to exclude derivatives of ethylene.

651 Using catalyst:
This subclass is indented under subclass 650. Subject matter wherein the process employs a catalyst.

652 Using O (partial combustion) or steam:
This subclass is indented under subclass 650. Subject matter wherein steam (usually superheated steam) is mixed with the feed or with the reaction effluent for heating or other purposes or wherein elemental oxygen is employed in the reaction.

(1) Note. This subclass does not include indirect heating or cooling where the medium passing through the coil is steam.

(2) Note. The oxygen must react with molecules which supply the atoms of the final product; the mere use of oxygen-containing gas to burn a fuel, which combustion merely supplies heat to the reaction, is not sufficient for placement of a patent herein.

653 Using catalyst:
This subclass is indented under subclass 648. Subject matter wherein a catalyst is employed in the reaction.

654 By dehydrogenation:
This subclass is indented under subclass 500. Subject matter wherein a monoolefin is produced by removing hydrogen from a molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:
330, for a process wherein a material is dehydrogenated before polymerization.
430, 440 and 603, for dehydrogenation processes yielding aromatics and diolefins.

655 With plural separation procedures applied to effluent or effluent component:
This subclass is indented under subclass 654. Subject matter wherein the effluent from the dehydrogenation reaction or a component thereof passes through at least two separation steps.

(1) Note. A mere nominal "recovery" or "separating" step is not sufficient to warrant placement of a patent herein.

(2) Note. Many patents contained herein seek to recover a separate hydrocarbon in addition to the main dehydrogenation product.

656 Using acceptor, e.g., hydrogen-exchange disproportionation, etc.:
This subclass is indented under subclass 654. Subject matter wherein the dehydrogenation employs an element or compound which chemically reacts with the removed hydrogen, being itself thereby changed to a more hydrogenated material.

SEE OR SEARCH THIS CLASS, SUBCLASS:
257, for a process wherein a hydrocarbon is the acceptor and the more hydrogenated hydrocarbon is a desired product.
433, and 617+, for similar processes yielding aromatics and diolefins, respectively.

657 Halogen-containing acceptor:
This subclass is indented under subclass 656. Subject matter in which the removed hydrogen combines with free halogen or a halogen-containing compound.

(1) Note. The reaction mixture may contain an agent for synthesizing elemental halogen in stoichiometric amounts in situ from a halogen compound, e.g., oxygen + HC1, etc.

658 Elemental O or S acceptor with extraneous nonhydrocarbon agent, e.g., catalyst, etc.:
This subclass is indented under subclass 656. Subject matter wherein the removed hydrogen combines with free oxygen and part or all of the synthesis takes place in the presence of a material which chemically affects the synthesis by promoting, retarding, etc., but which does not form a part of the desired product and is, at least in theory, separable from the desired reaction products. The agent may be a catalyst, solvent, etc.

659 Plural stages or with catalyst movement:
This subclass is indented under subclass 654. Subject matter wherein the effluent from a dehydrogenation reaction stage is passed to another dehydrogenation reaction stage or in which movement of solid extraneous agent is described.

660 Using extraneous agent containing Pt-group metal and non-Pt-group metal:
This subclass is indented under subclass 654. Subject matter wherein the synthesis takes place in the presence of an agent which comprises at least two metals, one of which is iridium, osmium, platinum, palladium, rhodium, or ruthenium and the other of which is a metal different from those listed.

SEE OR SEARCH THIS CLASS, SUBCLASS:
403, 503, 537, 636, and 920, for processes which employ apparatus of recited composition, in some cases the composition (e.g., a reactor lining) being or containing a catalytic agent.

661 Using transition metal oxide, sulfide, or salt:
This subclass is indented under subclass 654. Subject matter in which the synthesis takes place in the presence of an oxide, sulfide, or a salt containing a metal in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table transition metals include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

(1) Note. The transition metal may appear in the anion of a metal salt catalyst.

662 Cr, Mo, or W:
This subclass is indented under subclass 661. Subject matter in which the transition metal of the oxide, sulfide, or salt is chromium, molybdenum, or tungsten.

663 With other transition metal:
This subclass is indented under subclass 662. Subject matter in which the chromium molybdenum or tungsten metal, oxide, or sulfide is employed in combination with another transition metal oxide or sulfide.

664 By double-bond-shift isomerization:
This subclass is indented under subclass 500. Subject matter wherein the olefinic unsaturation (double bond) of a feed monoolefin molecule shifts to another position in the hydrocarbon molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:
377+, and 601+, for the synthesis by a double-bond-shift, of cycloolefins and diolefins, respectively.

665 Using organometallic catalyst:
This subclass is indented under subclass 664. Subject matter wherein the process employs a catalyst which comprises a compound containing both a metal and an organic moiety.

(1) Note. A metal is any element of the periodic table other than hydrogen, a noble gas, a halogen, a chalcogen, nitrogen, phosphorus, carbon, silicon, or boron.

SEE OR SEARCH THIS CLASS, SUBCLASS:
669, for a process in which the catalyst comprises aluminum halide complexed with a hydrocarbon.

666 Using aluminosilicate catalyst:
This subclass is indented under subclass 664. Subject matter in which an aluminosilicate composition such as a zeolite, clay, etc., is employed.

(1) Note. The aluminosilicate may be naturally occurring or synthetically formed, and often has a crystalline structure which may be modified in some way to remove or add a constituent, for example, by ion exchange or by impregnation techniques.

SEE OR SEARCH THIS CLASS, SUBCLASS:

377, for double-bond isomerization of an alicyclic in which an aluminosilicate catalyst is employed.

518, for isomerization of aromatic hydrocarbons in which an aluminosilicate catalyst is employed.

671, for olefin skeletal isomerization reactions in which aluminosilicate is used.

739, for paraffin skeletal isomerization reactions in which aluminosilicate is used.

667 Using P-containing catalyst:
This subclass is indented under subclass 664. Subject matter wherein the catalyst contains phosphorus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

740, for a process in which a phosphorus-containing catalyst is utilized to effect a change in the skeletal structure of a paraffin molecule.

668 Using S-containing catalyst:
This subclass is indented under subclass 664. Subject matter wherein sulfur is present in the catalyst.

SEE OR SEARCH THIS CLASS, SUBCLASS:

734+, in which a sulfur-containing catalyst may be utilized to effect a change in the molecular skeletal structure of a paraffin molecule.

669 Using halogen-containing catalyst:
This subclass is indented under subclass 664. Subject matter wherein the reaction employs a catalyst containing fluorine, chlorine, bromine, or iodine in elemental or combined form.

670 Using transition metal-containing catalyst:
This subclass is indented under subclass 664. Subject matter wherein a catalyst is employed which contains a transition metal in free or combined form.

(1) Note. The transition metals are elements in which an inner electron shell, rather than an outer shell, is partially filled. In the periodic table they include elements 21 through 30 (scandium through zinc), 39 through 48 (yttrium through cadmium), 57 through 80 (lanthanum through mercury), and 89 through 103 (actinium through lawrencium).

671 By skeletal isomerization:
This subclass is indented under subclass 500. Subject matter wherein a monoolefin hydrocarbon undergoes a skeletal rearrangement of its carbon atoms.

(1) Note. The hydrocarbon may go from a straight chain configuration to a branched configuration, from a less branched to a more branched configuration, or it may go in the reverse order from a more branched to a less branched or to a straight configuration.

SEE OR SEARCH THIS CLASS, SUBCLASS:

350, 477, 601, and 734+, for skeletal isomerization reactions which produce alicyclic, aromatic, diolefin, and paraffin products, respectively.

371+, for skeletal isomerization which results in enlarging or contracting an alicyclic ring.

375+, 470+, 643+, and 708, for processes in which a hydrocarbyl moiety from one molecule is transferred to another molecule to produce an alicyclic, aromatic, olefinic, or paraffin compound, respectively.

700 SATURATED COMPOUND SYNTHESIS:
This subclass is indented under the class definition. Subject matter in which a hydrocarbon molecule is produced which has no ring configuration and is saturated with hydrogen, that is, of the formula $C_nH_{2n}+2$ which molecule was not present as the same structurally or empiri-

cally identical molecule at the beginning of the process.

(1) Note. This subclass (700) is the locus for paraffin synthesis processes not provided for below, e.g., by condensation of saturated hydrocarbons, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
16, for saturated hydrocarbon products.

SEE OR SEARCH CLASS:
204, Chemistry: Electrical and Wave Energy, subclasses 157.15+ for chemical synthesis of a hydrocarbon compound by utilizing wave energy and subclasses 168+ for chemical synthesis of a hydrocarbon compound by utilizing an electrostatic field or electrical discharge.
518, Chemistry: Fischer-Tropsch Processes: or Purification or Recovery of Products Thereof, for hydrogenation of carbon oxides.

701 With measuring, sensing, testing, or synthesis operation control responsive to diverse condition:

This subclass is indented under subclass 700. Subject matter wherein the process involves a definitely recited step of measuring, analyzing, etc., a condition of parameter of the process or in which a condition of the synthesis operation, e.g., temperature, etc., is adjusted in accordance with a different aspect of the synthesis, e.g., strength of catalyst, etc.

(1) Note. A process in which the same operating condition is controlled e.g., adding heat to a reaction in response to a temperature drop in the reaction zone, is not included in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:
401, 501, for similar procedures employed in the synthesis of aromatic and unsaturated hydrocarbon compounds, respectively.
956, for a collection of patents disclosing such procedures in other aspects of hydrocarbon processing.

SEE OR SEARCH CLASS:
73, Measuring and Testing, for processes and apparatus for making a measurement or test of any kind not claimed in combination with synthesis of an organic compound and not elsewhere classifiable; and the Class Definition thereof for the identification of other classes concerned with testing.
436, Chemistry: Analytical and Immunological Testing, subclasses 1+ for a test or measurement associated with a chemical reaction not elsewhere classifiable, or analysis, by chemical methods, of organic material.

702 Synthesis catalyst, solvent, or component thereof used as agent in hydrocarbon purification or separation:

This subclass is indented under subclass 700. Subject matter in which a material which is a catalyst or solvent or component thereof already used, or to be used, in a synthesis operation is used as an agent for treating a hydrocarbon to improve the hydrocarbon by removing or making innocuous undesired materials contained in the hydrocarbon.

(1) Note. Where a catalyst or solvent used in a first hydrocarbon synthesis is further used in a second hydrocarbon synthesis, which second synthesis may result in separating out the catalyst from an additional hydrocarbon product, the second synthesis is not considered to be a separation treatment for this subclass.

(2) Note. The material used in the two treatments must be the same material, not merely two different batches of material having the same composition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
301, for a process in which the same catalyst, solvent, or component thereof is used in plural parallel syntheses.
311, and 312, for plural diverse serial syntheses which use the same catalyst or in which one synthesis rehabilitates the catalyst for the other synthesis, respectively.

703 By interaction with nonhydrocarbon:
This subclass is indented under subclass 702. Subject matter in which the used or to-be-used catalyst interacts with a nonhydrocarbon to separate the nonhydrocarbon from the hydrocarbon.

(1) Note. The separating action may be "physical", that is, adsorption or dissolving the nonhydrocarbon, or may be "chemical", that is, a reaction with the nonhydrocarbon, catalyzing a reaction of the nonhydrocarbon, etc.

(2) Note. Where the interaction of the catalyst is with both a hydrocarbon component and a nonhydrocarbon component, the patent is placed in subclass 702 and cross-referenced here.

704 With control of water content of recycled catalyst:
This subclass is indented under subclass 700. Subject matter in which catalytic material from a paraffin synthesis is recycled to the synthesis and during the recycle the water content of the catalyst is adjusted, e.g., by water removal, etc.

705 With removal of catalyst component from metal-hydrocarbon complex:
This subclass is indented under subclass 700. Subject matter wherein a metal-hydrocarbon sludge resulting from a paraffin synthesis is treated to remove catalyst component therefrom, usually for recycle of the component.

(1) Note. The removed component need not be metal containing.

(2) Note. The removed component need not be part of the complex but may be merely entrained or dissolved therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
240, for the treatment of waste sludge to recover a hydrocarbon mixture therefrom, usually for use as a fuel, etc.

706 With addition of reactor effluent component to catalyst as agent for rehabilitation or recycle:
This subclass is indented under subclass 700. Subject matter wherein a catalyst or catalyst component is rehabilitated (reactivated) and/or recycled to the paraffin synthesis reaction by adding to the catalytic material a portion of the reactor effluent, e.g., an unreacted feed fraction, etc., usually for use in transporting the catalyst.

(1) Note. The process generally will involve treatment of a reactor effluent to separate the components of the effluent and a recombination of a component rich in catalyst with another component poor in catalyst or free of catalyst.

SEE OR SEARCH THIS CLASS, SUBCLASS:
718, 719 and 738, for paraffin synthesis processes involving effluent separation procedures.

707 With specified procedure for adding fresh makeup catalyst component to complex (sludge), support, or inert contact material:
This subclass is indented under subclass 700. Subject matter in which the catalytic activity of a liquid or solid, usually inactive or less active, component of a paraffin synthesis catalyst is boosted by compositing fresh makeup catalyst therewith.

SEE OR SEARCH THIS CLASS, SUBCLASS:
702, for a paraffin synthesis process in which a support material is used to separate active catalyst component from a product mixture, resulting, incidentally, in a reconstituted catalyst composition.
705, for a paraffin synthesis process in which a catalyst component is removed from a metal-hydrocarbon complex.

708 By alkyl transfer, e.g., disproportionation, etc.:
This subclass is indented under subclass 700. Subject matter in which an alkyl moiety of a molecule is transferred to another molecule.

(1) Note. Patents are classified herein on the basis of the net result of the process, regardless of the mechanism involved, that is, the process may proceed by dimerization and cracking, as well as by free-radical transfer.

SEE OR SEARCH THIS CLASS, SUBCLASS:

257, 433, 440, 616, and 656, for disproportionation reactions involving the transfer of hydrogen between hydrocarbon molecules or hydrocarbyl moieties.

470+, and 643+, for alkyl or alkenyl transfer processes resulting in aromatic and insaturated products, respectively.

709 By condensation of a paraffin molecule with an olefin-acting molecule, e.g., alkylation, etc.:

This subclass is indented under subclass 700. Subject matter in which a paraffin molecule and an olefin molecule or the entire hydrocarbyl moiety of a nonhydrocarbon molecule are joined into a single molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:

422+, for a process wherein two aromatic molecules are joined.

446+, for a process wherein an alkyl moiety is joined to an aromatic molecule.

502+, for a process wherein two or more unsaturated hydrocarbon molecules are joined.

708, for a process wherein a hydrocarbon molecule and part of the hydrocarbon moiety of another molecule are joined (alkyl transfer).

SEE OR SEARCH CLASS:

208, Mineral Oils: Processes and Products, subclasses 133+ for processes of reforming mineral oils which may include alkylation reactions.

710 With catalyst rehabilitation by reversion from different compound or HF complex:

This subclass is indented under subclass 709. Subject matter wherein the alkylation effluent or a component thereof is treated to cause a chemical reaction, this reaction serving to form a chemical compound, suitable for use as a catalytic agent or catalyst component in subsequent alkylation reactions, the compound containing atoms which entered the original alkylation as part of the catalyst.

SEE OR SEARCH THIS CLASS, SUBCLASS:

311, for a similar process in which the chemical reaction serves also for hydrocarbon synthesis.

705, for a paraffin synthesis which involves removal of a catalyst component from a metal-hydrocarbon complex.

904, for a collection of patents drawn to catalyst rehabilitation, by the same method, in synthesis reactions other than alkylation to produce paraffins.

711 Including nonhydrocarbon reactant:

This subclass is indented under subclass 709. Subject matter wherein a hydrocarbyl moiety which is condensed is part of a molecule which contains other than carbon and hydrogen atoms.

SEE OR SEARCH THIS CLASS, SUBCLASS:

310+, and 930+, for processes which claim or disclose, respectively, the synthesis of the nonhydrocarbon intermediate.

712 With removal of organic halogen contaminant:

This subclass is indented under subclass 709. Subject matter in which an organic compound containing halogen is removed from the alkylation product or from a hydrocarbon stream in said process.

SEE OR SEARCH THIS CLASS, SUBCLASS:

310+, for a process wherein an alkyl fluoride by-product forms the intermediate in a hydrocarbon synthesis, especially subclass 311 where the synthesis is stated to produce HF for reuse as a catalyst in the procedure.

710, for a process where an organic halogen by-product is decomposed to produce a halide catalyst material.

711, for a process where an organic halide is used as an alkylating agent.

723+, and 729, for a alkylation processes which use hydrogen halide catalysts, promoters, etc.

713 Using solid catalyst or sorbent:
This subclass is indented under subclass 712. Subject matter in which a solid catalyst or sorbent is used to remove the organic halogen compound.

SEE OR SEARCH THIS CLASS, SUBCLASS:
718, for an alkylation process in which the effluent is treated with a solid sorbent for removal of materials other than organic fluorides.
820+, for a sorption process, per se, for purification of a hydrocarbon.

714 With introduction of same material at more than two serially spaced points of reaction zone system:
This subclass is indented under subclass 709. Subject matter wherein a feedstream of material, e.g., a catalyst, feedstock, recycle material, etc., which can be considered as coming directly from the same source, that is, having the same composition, is introduced to an alkylation reaction zone system at more than two points spaced along the flow path of the reactant material.

715 With autorefrigeration:
This subclass is indented under subclass 709. Subject matter in which the synthesis reaction zone is cooled by evaporation of the more volatile materials which are, or have been, present in the reaction zone.

(1) Note. The low boiling materials are vaporized by lowering the pressure with concomitant cooling of the remaining liquid hydrocarbons.

(2) Note. The chilled liquid hydrocarbon may be used to refrigerate the reaction zone directly or indirectly through heat exchanger walls.

SEE OR SEARCH THIS CLASS, SUBCLASS:
911+, for collections of patents concerned with introducing, maintaining, or removing heat by an atypical procedure other than autorefrigeration in a paraffin alkylation process.

716 Plural alkylation stages:
This subclass is indented under subclass 709. Subject matter in which the effluent from a paraffin alkylation reaction is sent to another paraffin alkylation reaction.

SEE OR SEARCH THIS CLASS, SUBCLASS:
300+, for a process wherein two or more alkylation reactions are conducted in parallel.
311+, for a process in which a paraffin alkylation reaction is preceded or followed by a conversion other than paraffin alkylation.

717 With preliminary treatment of feed:
This subclass is indented under subclass 709. Subject matter wherein the hydrocarbon feed is treated prior to the alkylation reaction, e.g., by separating nonhydrocarbon therefrom, by separating the feed into several different fractions, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
310+, for a process wherein an intermediate is formed by a chemical reaction before use in an alkylation process, especially subclass 332 for those processes wherein preliminary polymerization is carried out to obtain an olefin polymer and at least a portion of the olefin polymer is subsequently alkylated, or where the feedstock is isomerized before alkylation.

718 With coalescing or sorption of, or addition of specific agent to, effluent or effluent component:
This subclass is indented under subclass 709. Subject matter wherein the effluent from the alkylation reaction or a component thereof is treated, employing a chemical or physical phenomenon, to purify or separate the effluent or effluent component, the phenomenon being coalescence or sorption of with a solid sorbent, or requiring the addition of a material from outside the reaction mixture, e.g., a solvent, a reactant, a reaction inhibitor, etc.

(1) Note. See the notes to subclass 719 for a summary of other subclasses dealing with after treatments of alkylation effluent.

SEE OR SEARCH CLASS:
210, Liquid, Purification or Separation, subclasses 348+ and 634 and 702 for processes and apparatus, respectively, for coalescing where the purpose is to purify water or an unspecified liquid.
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is hierarchically superior provision in the USPC for the specifically claimed art.

719 With plural separation procedures applied to effluent or effluent component:
This subclass is indented under subclass 709. Subject matter wherein the effluent from the alkylation reaction or a component thereof passes through at least two separation steps.

(1) Note. A mere nominal "recovery" or "separating" step is not sufficient to warrant placement of a patent herein.

(2) Note. Many patents contained herein seek to recover a separate hydrocarbon in addition to the alkylate product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
331, for a process where an alkylation reaction is followed by a diverse conversion to produce a paraffin.
702+, 705 and 706, for paraffin syntheses in general which may or do involve specifically directed separation or purification procedures.
710, and 712, for alkylation procedures involving specifically directed purification or separation procedures.
716, for a process wherein the alkylation effluent is subjected to another alkylation reaction.

720 With specified flow procedure within or at entrance to reactor, e.g., by use of named mixing device, etc.:
This subclass is indented under subclass 709. Subject matter wherein a procedure for achieving contact and/or confluence of materials in the reactor or at the entrance to the reactor is specified.

SEE OR SEARCH THIS CLASS, SUBCLASS:
922+, for a collection of patents drawn to other hydrocarbon conversion processes wherein a reactor fluid manipulating device is specified.
955, for a collection of patents drawn to other hydrocarbon synthesis processes in which a mixing procedure is specified.

721 Using extraneous nonhydrocarbon agent:
This subclass is indented under subclass 709. Subject matter wherein part or all of the synthesis takes place in the presence of material containing an atom other than carbon and hydrogen, which chemically affects the synthesis by promoting, retarding, etc., which does not form a part of the desired product and is, at least in theory, separable from the desired reaction products. The agent may be a catalyst, solvent, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
403, 503, 537, 636, and 920, for processes which employ apparatus of recited composition, in some cases the composition (e.g., a reactor lining) being or containing a catalytic agent.
520+, for a polymerization reaction utilizing an ethylenically unsaturated feed in the presence of a chemically effective agent, e.g., catalyst.
704, 706, 707, 710, and 712, for certain procedures in paraffin synthesis in general or alkylation in particular

dealing with catalysts and catalyst components.

SEE OR SEARCH CLASS:
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is hierarchically superior provision in the USPC for the specifically claimed art.

722 Aluminosilicate or organometallic:
This subclass is indented under subclass 721. Subject matter wherein the agent comprises an aluminosilicate or organometallic compound.

(1) Note. Aluminosilicate includes zeolites or molecular sieves, both natural occurring and synthetically produced.

(2) Note. An aluminum halide complex with a hydrocarbon or nonhydrocarbon organic material is not considered to be an organometallic compound for this subclass.

723 HF:
This subclass is indented under subclass 721. Subject matter wherein an agent is hydrogen fluoride.

SEE OR SEARCH THIS CLASS, SUBCLASS:
702, for a paraffin synthesis procedure in which HF catalyst is also used as an agent for hydrocarbon separation or purification.
710, for an alkylation process which includes the recycle of HF removed from a compound or a complex contained in the alkylation effluent.
716, for a process wherein fluoride is present in at least one stage of a plural-stage alkylation process.

724 With additional nonhydrocarbon agent:
This subclass is indented under subclass 723. Subject matter wherein there is present during the reaction a promoter, catalyst, etc., in addition to the hydrogen fluoride.

725 B-, N-, or P-containing:
This subclass is indented under subclass 724. Subject matter wherein the additional agent comprises boron, nitrogen, or phosphorus in elemental or combined form.

(1) Note. This subclass contains, for example, alkylation processes wherein the catalyst comprises HF + BF_3.

726 B-containing:
This subclass is indented under subclass 721. Subject matter wherein the agent comprises boron in elemental or combined form.

(1) Note. This subclass contains a boron compound, alone or in admixture or combination with other substance, except in admixture with hydrogen fluoride.

SEE OR SEARCH THIS CLASS, SUBCLASS:
725, for an alkylation process in which hydrogen fluoride is used with a boron, nitrogen, or phosphorus compound or element, e.g., HF + BF_3, etc.

727 Al halide:
This subclass is indented under subclass 721. Subject matter wherein the agent comprises an aluminum halide.

(1) Note. This subclass (727) is the locus for a process using, as a catalyst, an aluminum halide complexed with a hydrocarbon.

SEE OR SEARCH THIS CLASS, SUBCLASS:
728, for a process wherein the aluminum halide is used as a complex with an ether, etc.

728 With additional nonhydrocarbon agent:
This subclass is indented under subclass 727. Subject matter wherein an additional chemically effective agent is used with the aluminum halide catalyst, the agent containing elements other than carbon and hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
727, wherein the aluminum halide is utilized as a complex with a hydrocarbon, without an additional nonhydrocarbon agent, e.g., nonhydrocarbon promoter, etc.

729 H halide:
This subclass is indented under subclass 728. Subject matter wherein hydrogen chloride, bromide, or iodide is an additional agent.

SEE OR SEARCH THIS CLASS, SUBCLASS:
721, for an alkylation process wherein a hydrogen chloride, bromide, or iodide is used alone or in admixture with another catalyst not specified in any of the preceding subclasses.
723+, for an alkylation process employing HF as an extraneous agent.

730 S-containing:
This subclass is indented under subclass 721. Subject matter wherein an extraneous agent is elemental sulfur or a sulfur compound.

731 Sulfuric acid with additional nonhydrocarbon agent:
This subclass is indented under subclass 730. Subject matter wherein there is present during the process a sulfuric acid catalyst and an additional chemically effective agent which is a nonhydrocarbon.

732 O-containing:
This subclass is indented under subclass 721. Subject matter in which the extraneous agent is elemental oxygen or an oxygen compound, e.g., water, alumina, phosphoric acid, etc.

733 From nonhydrocarbon feed:
This subclass is indented under subclass 700. Subject matter in which a paraffin product is produced from a feedstock containing an element other than merely carbon and hydrogen.

734 By isomerization:
This subclass is indented under subclass 700. Subject matter wherein a paraffin hydrocarbon undergoes a skeletal rearrangement of its carbon atoms.

(1) Note. The hydrocarbon may go from a straight chain configuration to a branched configuration, for a less branched to a more branched configuration, or it may go in the reverse order from a more branched to a less branched or to a straight configuration.

(2) Note. This subclass (734) is the locus for skeletal-type isomerization utilizing a catalyst that is not provided for in any of the indented subclasses below.

SEE OR SEARCH THIS CLASS, SUBCLASS:
350, 477, 601, and 671, for skeletal isomerization reactions which produce alicyclic, aromatic, diolefin, and olefin products, respectively.
371+, for skeletal isomerization which results in enlarging or contracting an alicyclic ring.
375+, 470+, 643+, and 708, for processes in which a hydrocarbyl moiety from one molecule is transferred to another molecule to produce an alicyclic, aromatic, olefinic, or paraffin compound, respectively.

735 Using temperature gradient or material concentration gradient or introduction of same material at more than two serially spaced points of reaction zone system:
This subclass is indented under subclass 734. Subject matter wherein feedstreams of a material, e.g., a catalyst, feedstock, recycle material, etc., which can be considered as coming directly from the same source, that is, having the same composition, are introduced to an isomerization reaction zone system at more than two points spaced along the flow path of

the reactant materials, or in which temperature conditions or the concentration of materials in the reactor is stated as changing gradually in space, that is, in the flow path of materials through a reaction zone from inlet to outlet, or in time, that is, from the moment that the reactor is put on stream until it is taken off stream.

SEE OR SEARCH THIS CLASS, SUBCLASS:

736, for an isomerization reaction which takes place in a series of distinct stages, without a stated gradual change of conditions from one stage to another.

736 Plural isomerization stages:

This subclass is indented under subclass 734. Subject matter in which the effluent from an isomerization reaction is sent to another isomerization reaction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

300+, for a process wherein two or more isomerization reactions are conducted in parallel.

332, for a process wherein an isomerization reaction is followed by an alkylation or alkyl transfer reaction to produce a branched-chain paraffin.

737 With preliminary treatment of paraffin feed:

This subclass is indented under subclass 734. Subject matter wherein the hydrocarbon feed is treated prior to the isomerization reaction by chemically modifying the feed or by separating nonhydrocarbons therefrom, or by separating the feed into several different fractions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

331, for those processes wherein an alkylation reaction is carried out initially and a portion of the alkylate product is subsequently isomerized.

738 With specified isomerizate purification or separation procedure:

This subclass is indented under subclass 734. Subject matter wherein the effluent from the isomerization reaction is treated, usually by a series of steps, to improve its quality or purity in some way.

(1) Note. A mere nominal "recovery", or "separating" step is not sufficient to warrant placement of a patent herein.

(2) Note. The procedure may involve a chemical reaction but does not result in the net synthesis of a desired, recoverable hydrocarbon or other product.

SEE OR SEARCH THIS CLASS, SUBCLASS:

331, for a process wherein isomerization is followed by alkylation or alkyl transfer to produce a branched-chain paraffin product.

705, for a process which includes the removal of a catalyst component, e.g., aluminum halide, etc., from sludge.

739 Using aluminosilicate catalyst:

This subclass is indented under subclass 734. Subject matter wherein the catalyst consists of or includes an aluminosilicate, such as a zeolite or molecular sieve.

(1) Note. The aluminosilicate may be a naturally occurring or synthetic composition, which may be modified in some way to remove or to add a constituent, for example, by ion exchange or by impregnation techniques.

SEE OR SEARCH THIS CLASS, SUBCLASS:

666, for reactions in which aluminosilicate is utilized to effect a double-bond shift in a hydrocarbon.

750, for an isomerization process using another metal oxide catalyst.

740 Using B- or P-containing catalyst:

This subclass is indented under subclass 734. Subject matter wherein the catalyst includes boron or phosphorus in free or combined form.

741 Using Al halide catalyst:

This subclass is indented under subclass 734. Subject matter employing a catalyst which comprises an aluminum halide, alone or including additional agents or materials.

SEE OR SEARCH THIS CLASS, SUBCLASS:

705, and 707, for certain specialized procedures for treating the catalyst, which often is an aluminum halide catalyst, in an isomerization or alkylation procedure.

742 With additional metal halide:

This subclass is indented under subclass 741. Subject matter wherein the reaction mass includes two different halides of aluminum or the halide of a metal other than aluminum, e.g., antimony chloride, besides the aluminum halide.

743 With S-containing or free or organic halogen agent:

This subclass is indented under subclass 741. Subject matter wherein the reaction mass includes elemental halogen or sulfur, a sulfur compound or an organic halogen compound.

(1) Note. An aluminum halide-hydrocarbon complex is not considered an organic halogen compound for this subclass.

744 With metal oxide or elemental carbon, e.g., supported, etc.:

This subclass is indented under subclass 741. Subject matter wherein a metal oxide or elemental carbon is included in the reaction mass, usually to support the aluminum halide.

(1) Note. A material described merely as an "inert refractory material" is assumed to be a metal oxide.

SEE OR SEARCH THIS CLASS, SUBCLASS:

739, for an isomerization process in which a crystalline aluminosilicate is employed.

742, if an additional metal halide is used with aluminum halide on a metal oxide or elemental carbon support.

745 With added organic agent or in complex with organic material:

This subclass is indented under subclass 741. Subject matter wherein the reaction mass contains (a) a complex of aluminum halide with an organic compound, e.g., sludge, red oil, etc., (b) an organic material other than the reactants, deliberately added to the reaction mass, or (c) a hydrocarbon material other than the reactants is recycled to the reaction mass to form a definite proportion of the reaction mass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

901, 954, for collections of patents concerned with mass-action phenomena.

746 With inorganic material other than halogen-containing:

This subclass is indented under subclass 741. Subject matter wherein an inorganic additive or agent which does not contain halogen is included along with the aluminum halide catalyst.

747 Using halogen-containing catalyst:

This subclass is indented under subclass 734. Subject matter wherein the catalyst utilized in the isomerization includes halogen in its composition.

748 With alumina:

This subclass is indented under subclass 747. Subject matter wherein aluminum oxide is included in the reaction mass.

(1) Note. The catalyst of the instant subclass is not recognized as an aluminum halide and the reaction is not carried out in the presence of any aluminum halide or any modified catalyst resulting from an aluminum halide.

SEE OR SEARCH THIS CLASS, SUBCLASS:

741+, for an isomerization process containing aluminum halide in the reaction step.

749 F:

This subclass is indented under subclass 748. Subject matter wherein fluorine or a fluorine compound is included in the reaction mass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

744, for an isomerization process using a catalyst containing both aluminum halide and a fluorine-containing alu-

mina or a fluoride compound on an alumina-containing support.

750 Using metal oxide or hydroxide catalyst:
This subclass is indented under subclass 734. Subject matter wherein the catalyst comprises a metal oxide or metal hydroxide, either alone or on a refractory inorganic support, such as silica, etc.

751 Including free metal:
This subclass is indented under subclass 750. Subject matter wherein a metal in the elemental state is included along with a metal oxide or metal hydroxide in the catalyst.

SEE OR SEARCH THIS CLASS, SUBCLASS:
671, for skeletal isomerization of an olefin using a metal catalyst.

752 By C content reduction, e.g., hydrocracking, etc.:
This subclass is indented under subclass 700. Subject matter wherein the saturated hydrocarbon is produced from a feedstock having a greater number of carbon atoms than the product.

SEE OR SEARCH THIS CLASS, SUBCLASS:
708, for a process wherein a hydrocarbon moiety removed from one molecule is added to another molecule.
733, for a process in which removing a foreign atom may result in a paraffin product having fewer carbon atoms.
734+, for a process wherein a hydrocarbon moiety removed from one carbon of a molecule is joined to a different carbon of the same molecule.

800 PURIFICATION, SEPARATION, OR RECOVERY:
This subclass is indented under the class definition. Processes in which a mixture of a hydrocarbon compound with another substance is treated to recover that same compound in a more usable condition, that is, a purer or less undesirable condition, by a treatment which comprises separating the hydrocarbon from the other substance or making the other substance less obnoxious.

(1) Note. The other substance may be other hydrocarbons of this class (585) whether desired or not, nonhydrocarbon materials, or hydrocarbon materials classified elsewhere, the recovery of which is not desired.

(2) Note. To be classified in these subclasses (800+) the recovered hydrocarbon must enter the process and leave the process as the same compound, even though it may be converted to an intermediate and reverted to the original compound during the course of the process.

(3) Note. In general, the subject matter provided for herein includes chemical, physical and chemical, and physical processes directed to the purification or separation of those hydrocarbon compounds covered by the definition of this class, unless such treatment is provided for elsewhere as pointed out in the notes below.

(4) Note. See the Class Definition, Lines With Other Classes and Within This Class, "Lines between Subclasses 800+ and Other Areas for a discussion of the hierarchical relationship among (1) this subclass and its indents and (2) other areas.

801 By conversion of solid to gas, e.g., sublimation, etc., or by melting or squeezing out liquid from solid natural source:
This subclass is indented under subclass 800. Subject matter wherein hydrocarbon contained in a solid material (including a fluent solid) is converted to a gas without existing in the liquid state for any significant amount of time, or wherein the hydrocarbon is recovered as a liquid by application of heat or pressure to a solid source of the hydrocarbon found in nature, e.g., recovery of turpentine from wood, etc.

SEE OR SEARCH CLASS:
201, Distillation: Processes, Thermolytic, for a process wherein a hydrocarbon material is removed from a solid source as a gas and subsequently con-

densed, some of the original material being converted to char.

802 By plural serial diverse separations:
This subclass is indented under subclass 800. Subject matter wherein a feedstock containing the hydrocarbon material is subjected to a series of separation procedures which differ from each other in their mechanism, usually to separate the starting mixture into more than two components, to nullify the effect of more than one component, to free the recoverable material from a byproduct of the separation process, etc.

(1) Note. A mere nominal "separating", "settling", or "filtering" step following the addition of a material to the hydrocarbon mixture is not sufficient for classification herein.

(2) Note. A mere reversal of the procedure employed in a first step, e.g., desorption after sorption, removal of a solvent from the extract phase, etc., is not considered to be a plural diverse separation procedure even when the reversal is practiced fractionally. See subclasses 825, 835, and 839 below.

(3) Note. Addition of a material to the feed, e.g., a complexing agent, solvent, etc., to facilitate subsequent crystal formation by chilling, is not sufficient for classification herein. See subclass 816 below.

(4) Note. Diversity exists when the separation mechanisms are provided for in different classes of the Patent and Trademark Office classification, including some different main line subclassifications in Classes 95, Gas Separation: Processes; 62, Refrigeration; 210, Liquid Purification or Separation or in different "one indent" subclasses subsumed by subclass 800.

SEE OR SEARCH CLASS:
203, Distillation: Processes, Separatory, for a distillation process preceded by a chemical reaction which facilitates the distillation or followed by a diverse separation procedure which does not involve a chemical reaction.

803 To recover alicyclic:
This subclass is indented under subclass 802. Subject matter wherein a recovered material is an alicyclic hydrocarbon, e.g., a terpene, carotene, etc.

804 To recover aromatic:
This subclass is indented under subclass 802. Subject matter in which an aromatic hydrocarbon is purified or separated out from a mixture.

805 Xylene or ethylbenzene:
This subclass is indented under subclass 804. Subject matter wherein the hydrocarbon is one or more xylene isomer(s).

806 Having unsaturated or one-C side-chain:
This subclass is indented under subclass 804. Subject matter wherein the aromatic hydrocarbon has a methyl or an unsaturated side-chain, e.g., styrene, etc.

807 Including steps of distillation and agent addition:
This subclass is indented under subclass 804. Subject matter in which the plural separations include distillation and the addition of an extraneous agent.

SEE OR SEARCH CLASS:
203, Distillation: Processes, Separatory, for a process which includes distillation and previous addition of an agent which causes or assists in a chemical reaction designed to make the distillation effective or more effective, or a process which includes distillation and a subsequent "physical" separatory step, e.g., solvent extraction.

808 Agent contains N, carbonyl, or dihydroxy moiety:
This subclass is indented under subclass 807. Subject matter in which the agent added in a purification step contains nitrogen or the keto -C--C moiety or the aldehyde -C=O moiety or has two hydroxyl groups.

809 To Recover Unsaturate:
This subclass is indented under subclass 802. Subject matter wherein an unsaturated hydrocarbon, e.g., an olefin, an alkyene, etc., is purified or separated out from a mixture.

810 Diolefin:
This subclass is indented under subclass 809. Subject matter wherein a recovered product has two double bonds.

811 Including treatment with S-containing agent:
This subclass is indented under subclass 809. Subject matter wherein one of the steps of the process includes treatment of a material with an agent which contains sulfur in free or combined form.

SEE OR SEARCH THIS CLASS, SUBCLASS:
856+, for hydrocarbon purification treatments in general which involve use of a sulfur containing agent.

812 By cooling of liquid to obtain solid, e.g., crystallization, etc.:
This subclass is indented under subclass 800. Subject matter wherein the purification, separation, or recovery process includes lowering the temperature of a liquid mixture, containing a hydrocarbon to be recovered, to cause one or more components of the mixture to solidify.

SEE OR SEARCH CLASS:
34, Drying and Gas or Vapor Contact With Solids, for a process of separating liquids from solids or slurries which may result in the formation or recovery of a crystal-line substance.
62, Refrigeration, subclasses 532+ for a crystallization process accomplished by chilling which is claimed as being applicable to more than only hydrocarbon separation or purification.
117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for processes for growing therein-defined single-crystal of all types of materials, including inorganic or organic. See the Class 117 definition for guidance in placement of single-crystal related art.
159, Concentrating Evaporators, for a process which may include formation of crystals from a liquid suspension or solution by removal of a solvent liquid.

813 Using specified holding time or specified cooling rate:
This subclass is indented under subclass 812. Subject matter wherein an amount of cooling is claimed as taking place during a claimed period of time or the amount of time during which the mixture or a component thereof is held at a certain temperature or within a certain temperature range is claimed.

(1) Note. The cooling rate may be specified as a constant such as 105/ hr or by a time dependent formula.

814 With treatment of mother liquor after crystal separation:
This subclass is indented under subclass 812. Subject matter wherein solids are removed from a remaining liquid and the liquid is given a further treatment, usually to remove further components from the liquid by another crystallization.

SEE OR SEARCH THIS CLASS, SUBCLASS:
479, for synthesis of aromatic compounds by isomerization following by a plurality of separation steps, one of which is crystallization.
802+, for a hydrocarbon separation process which includes crystallization and a diverse separation procedure, e.g., a subsequent distillation.

815 With dissolving or plural serial crystallizations:
This subclass is indented under subclass 812. Subject matter wherein the starting mixture or a solid produced in the process is dissolved in a liquid or in which a component of a liquid mixture is chilled to form a solid, the solid is liquefied and the resulting liquid is again chilled to form a solid component.

SEE OR SEARCH THIS CLASS, SUBCLASS:
814, for a process in which the second crystallization is applied to the mother liquor obtained from the first crystallization.

816 With addition of extraneous material:
This subclass is indented under subclass 812. Subject matter in which a material from an outside source is added to the hydrocarbon to be recovered to perfect the solidification procedure, e.g., by washing the resulting solids, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
802+, for a process where crystallization and agent addition are performed serially upon a starting mixture, the agent being added for a purpose other than perfection of the crystallization procedure.
815, for a process where the added material is a solvent.

817 Before crystal formation:
This subclass is indented under subclass 816. Subject matter in which the material is added before the chilling step is completed.

(1) Note. The added material often is one which forms a complex with a component of the mixture.

818 By membrane, selective septum, or coalescer:
This subclass is indented under subclass 800. Subject matter wherein a liquid hydrocarbon is recovered from a liquid mixture containing the hydrocarbon by the use of a solid apparatus member having one of the following features: (a) is a thin member which permits the passage of molecules or ions having a certain size or shape while excluding molecules or ions having a larger size or bulkier shape; (b) is a porous member which because of its composition permits the passage of a certain type of molecule, e.g., a polar molecule, while preventing the passage of molecules of incompatible type, or (c) is a member which because of its composition causes finely divided liquid material dispersed in another liquid to form larger drops.

SEE OR SEARCH THIS CLASS, SUBCLASS:
718, for an alkylation synthesis process which is followed by coalescing a component, usually water, contained in the effluent.

SEE OR SEARCH CLASS:
95, Gas Separation: Processes, subclasses 43+ for processes of gas separation by selective diffusion of gases through a substantially solid barrier.
127, Sugar, Starch, and Carbohydrates, subclass 54 for a dialyzing process peculiar to treatment of sugar solutions.
204, Chemistry: Electrical and Wave Energy, subclasses 513+ for electrophoretic or electro-osmotic separation or purification of a hydrocarbon oil and subclasses 559+ for electrical separation or purification, in general, of a liquid hydrocarbon.
210, Liquid Purification or Separation, subclass 634 for dialysis processes; and subclass 702 for coalescing processes.
516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is hierarchically superior provision in the USPC for the specifically claimed art.

819 Aromatic permeate:
This subclass is indented under subclass 818. Subject matter wherein an aromatic component of the hydrocarbon mixture passes through the membrane or septum.

820 By contact with solid sorbent:
This subclass is indented under subclass 800. Subject matter wherein a solid mass is used to retain on its surface or inside its pores a constituent of a mixture from which hydrocarbon is to be recovered.

(1) Note. “Solid sorbent” includes but is not limited to diatomaceous earth, kieselguhr, perlite, activated carbon, asbestos, colloidal clays, molecular sieves, silica

gel, ion-exchange zeolites, and resins, etc.

(2) Note. Sorption processes depend for their effectiveness upon the shape or chemical composition of the molecules retained by the solid sorbent. They thus are distinguishable from filtration processes which depend upon a mechanical entrapment of solid particles because of their relatively large size compared to the interstices or spaces between individual elements of a filter. In the case of a filter mechanical brushing, wiping, shaking, etc., will remove the retained particles. Sorption processes which depend for their effectiveness upon molecular shape generally employ a "molecular sieve" which usually is a natural or synthetic metal aluminum silicate or similar material whose atoms are arranged in a crystal lattice in such a way that there are a large number of small pores interconnected by smaller openings or pores of precisely uniform size. The most common molecular sieves are zeolites, a class or natural or manufactured hydrated silicates of aluminum and either sodium or calcium or both, of the type $Na_2O.A1_2O_3.nSiO_2.xH_2O$. They will accept and retain molecules that are small and/or slender enough to pass through the pores, thus separating them from a mixture with larger or bulkier molecules.

Other sorption processes separate a constituent from a fluid mixture containing such constituents in a "quasi-chemical" manner. The action in most instances is that of selective retention, e.g., the sorbent interacts with and thereby retains only the part of the fluid mixture for which it has the greatest affinity. The retained portion cannot be removed by mechanical action but generally requires heating or use of a stripping or desorbing fluid.

(3) Note. Ion exchange is a chemical metathesis process in which ions are chemically transferred from a usually liquid material to a usually solid separatory substance or exchanger which has a chemical structure of loosely bound ions. The exchanger substance can usually be regenerated by passing another material through it to elute the exchanged ions and replace them with the original kind of loosely bound ions. When a patent calls a process involving an ion exchanger "sorption", the process is placed in these subclasses (820+), but when the true mechanism of the separatory procedure appears to be ion exchange, it is cross-referenced to subclasses 833+ below.

SEE OR SEARCH CLASS:

95, Gas Separation: Processes, subclasses 90+ for processes of gas separation using solid sorbents.

203, Distillation: Processes, Separatory, subclass 41 for separatory distillation process including the step of passing the distillate material through a solid sorbent.

208, Mineral Oils: Processes and Products, subclass 310 for mineral oil fractionation processes which include adsorption.

210, Liquid Purification or Separation, subclasses 656+ and 660 for liquid purification by ion exchange or sorption, wherein the process is directed to the purification of water or a number of compounds, one of which is water, or if the claims are broad, as to the liquid purified. Where claims or disclosure specific to hydrocarbon purification indicates classification in this class, subclasses (820+) and that patent contains claims to the separation of any other liquid or fluid mixture, the patent is cross-referenced to Class 210.

821 With measuring, sensing, testing, or recycle of sorbate to same sorption zone:

This subclass is indented under subclass 820. Subject matter wherein a positive step of measuring, sensing, or testing a component or parameter of the feedstock, product or sorption zone is recited or in which material sorbed in the process and later desorbed from the sorbent is recycled to the sorption zone, generally to act as a reflux.

822 Plural serial sorptions:
This subclass is indented under subclass 820. Subject matter in which an effluent from a sorption step or zone is passed through another sorption zone.

(1) Note. The effluent may comprise the unsorbed portion of the feed (the raffinate) or the sorbed and desorbed portion of the feed (the extract or sorbate).

(2) Note. A process wherein a "guard bed" of sorbent is employed along with a main sorbent zone is classified herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
802+, for a process wherein sorption is preceded or followed by a diverse separation procedure.

823 Sorbate is nonhydrocarbon or chemically undetermined component, e.g., "color-former", etc.:
This subclass is indented under subclass 820. Subject matter wherein the constituent removed from the mixture contains an element other than carbon and hydrogen or is elemental carbon or in which the disclosure fails to indicate exactly what elements go to make up the removed constituent.

(1) Note. Where the removed constituent is indicated as being a hydrocarbon, the patent is not classified here, although when such constituent is described as a sensible material (e.g., colored or having an odor) or a precursor of such a material, the patent may be cross-referenced here (subclasses 823+).

SEE OR SEARCH CLASS:
424, Drug, Bio-Affecting and Body Treating Compositions, which are not applies to the living body which function by chemical combination with the odor-causing organism or by desensitizing the olfactory mechanism.

824 O-containing sorbate:
This subclass is indented under subclass 823. Subject matter wherein the removed constituent contains oxygen e.g., water, etc.

825 With fractional or linear desorption, e.g., chromatography, etc.:
This subclass is indented under subclass 820. Subject matter in which a desorption step removes only part of the sorbate from the sorbent or in which during at least the desorption step the sorbent material is held in a relatively fixed arrangement and the desorption creates a more or less distinct boundary or "front" between that part of the sorbent mass which still contains sorbate and that part of the sorbent mass from which sorbate has been wholly or partially removed.

(1) Note. The process may be one in which a plurality of different materials are adsorbed and the desorption serves to remove only one or a selected group of the materials or serves to remove different materials at different times, usually due to a change in desorption conditions, e.g., the desorbing agent employed, etc.

(2) Note. A purge of unsorbed material from the interstices between sorbent particles is not considered to be desorption.

(3) Note. A chromatos:graphic process, wherein a solution of the hydrocarbon which is to be separated or purified is allowed to flow slowly through a mass of adsorbent and different substances in the feed solution pass with different rates through the mass and separate into zones, is not included in this subclass unless the desorption is such as to permit separate recovery of the different substances.

SEE OR SEARCH CLASS:
73, Measuring and Testing, subclass 23.35 for gas analysis by chromatography; and subclass 863 for gas samplers.
210, Liquid Purification or Separation, subclass 656 for chromatos:graphic separation processes of general utility or directed to water purification.

826 With specified sorbent rehabilitation procedure or agent, e.g., desorbent, etc.:
This subclass is indented under subclass 820. Subject matter in which a procedure for rehabilitation of the sorbent is described as more than mere "desorption", "recovery of sorbed material", or "purging", etc., or in which an agent for removing desorbed material is described in more specific terms than merely a "desorbent", etc.

827 Cyclic sorbate:
This subclass is indented under subclass 826. Subject matter in which an aromatic or alicyclic hydrocarbon is a material retained by the sorbent during the sorption cycle.

828 Aromatic separated from other aromatic:
This subclass is indented under subclass 827. Subject matter in which a material retained by the sorbent in the sorption cycle is an aromatic compound and in which a material not retained by the sorbent in this cycle is also an aromatic compound.

829 Unsaturated sorbate:
This subclass is indented under subclass 826. Subject matter in which an acyclic hydrocarbon having olefinic or acetylenic unsaturation is the material retained by the sorbent during the sorption cycle.

830 Sorbent is or contains organic:
This subclass is indented under subclass 820. Subject matter in which the sorbent is an organic solid or contains an organic material, e.g., an inorganic sorbent coated with an organic material, etc., which is not part of the recoverable product of the process.

831 Cyclic sorbate:
This subclass is indented under subclass 820. Subject matter in which an aromatic or alicyclic hydrocarbon is a material retained by the sorbent.

832 Polymerization and depolymerization:
This subclass is indented under subclass 800. Subject matter which includes a step of chemically condensing olefinic molecules in the hydrocarbon mixture followed, usually after filtration or gravitational separation, by depolymerization of the condensed material.

SEE OR SEARCH CLASS:
203, Distillation: Processes, Separatory, subclass 30 for a separation process which includes polymerization of an unsaturated component followed by distillation.

833 By addition of extraneous agent, e.g., solvent, etc.:
This subclass is indented under subclass 800. Subject matter in which a material which does not form part of the desired product is added to the mixture to be purified or separated as an aid to such purification or separation.

(1) Note. The mechanism by which the material aids the process may be any mechanism not provided for above, e.g., the material may be a catalyst, solvent, a complexing agent, etc.

(2) Note. This subclass (833) provides for a process wherein an acid such as HC1 is added for purification purposes; however, when the claims require an aqueous solution of such acid to be added, classification is proper in subclass 868.

SEE OR SEARCH THIS CLASS, SUBCLASS:
816, for a separation process which involves agent addition and chilling to solidify a complex formed by the agent and a component of the feed mixture.

SEE OR SEARCH CLASS:
8, Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers, subclasses 438, 439, and 646 for extracts which have been specifically prepared or treated to fit them for use as organic coloring material.
95, Gas Separation: Processes, subclasses 149+ for processes of gas separation using liquid contacting.
203, Distillation: Processes, Separatory, subclasses 50+ for an extractive distillation process, per se, that is, a distillation process carried out in the presence of a solvent for one or more components of the distilland.

208, Mineral Oils: Processes and Products, subclasses 31 and 33+ for processes wherein waxes are dissolved form mineral oil containing subclasses; subclass 45 for the solvent extraction of asphalts, tars, pitches, or resins from mineral oils; subclasses 311+, 390, and 400 for processes wherein mineral oils are dissolved from mineral oil containing substances; and subclass 298 for processes of refining mineral oils by treating with liquid treating agents (washing, etc.).

210, Liquid Purification or Separation, subclasses 634+ for a process of liquid-liquid extraction wherein one of the compounds purified is water or if the claims are broad as to the liquid being purified.

423, Chemistry of Inorganic Compounds, particular subclass 658.5 and subclasses noted thereunder for a process of leaching, extracting, or dissolving when a process for purifying an inorganic or nonmetallic compound provided for in Class 423 is claimed, or when the claims are not limited and disclosure of purification of a compound for Class 423 and a compound or composition for that class is present, or a coclaimed extraction process produces products provided for in each of a plurality of other classes.

424, Drug, Bio-Affecting and Body Treating Compositions, appropriate subclasses for an extract of undetermined constitution even though from a single source, which has a utility provided for in that class; and see especially subclasses 520+ for an animal extract; and subclasses 725-779 for a plant extract.

426, Food or Edible Material: Processes, Composition, and Products, particularly subclass 425 and the noted subclasses thereunder for processes of making an extract having a Class 426 utility and not provided for elsewhere even though a hydrocarbon is mixed with other substances to form a product with Class 426 utility. See the Class 426 class definition, section II B (1) for an elaboration of the line between this class and Class 426.

516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 113+ for compositions for or subcombination compositions for or breaking of or inhibiting of colloid systems (e.g., foam breaking, emulsion breaking, dispersion inhibiting, suspension settling, gel breaking, smoke suppressing, coagulating, flocculating), when generically claimed or when there is hierarchically superior provision in the USPC for the specifically claimed art.

834 With contact procedure involving particular apparatus or more than two moving streams:

This subclass is indented under subclass 833. Subject matter wherein contact of the feedstock with the agent is specified as taking place in an apparatus of defined structure or involves specified movement of three or more streams of material.

(1) Note. Generally more than mere nominal “counter-current contact” is required for placement in this subclass.

(2) Note. The streams generally are liquid and will involve more than merely feed, solvent, extract and raffinate streams, for example, a reflux and/or wash stream will generally need to be flowing simultaneously to make up the three or more discrete moving streams.

835 With fractional disengagement from agent by use of other agent:

This subclass is indented under subclass 833. Subject matter wherein a hydrocarbon-containing feedstock or a portion thereof, engaged with an extraneous agent, e.g., dissolved in a solvent, complexed with a complexing agent, etc., is treated with a second agent to remove a part only of the engaged nonagent material.

(1) Note. The partial disengagement may be followed by treatment for disengagement of more of the same or different

nonagent material by the same or different second agent.

(2) Note. The partial disengagement may be for the removal of undesirably engaged material, e.g., washing out of recoverable material which adheres to the complex, etc.

836 Different, sequentially used agents:
This subclass is indented under subclass 933. Subject matter wherein a plurality of different agents are added one after the other to all or part of the feedstock.

(1) Note. "Different" is intended to mean chemically different materials and not a single material in different stages of contamination or dilution with hydrocarbon as would be formed during concurrent extraction.

837 One agent is a diluent, i.e., nonselective solvent or heat exchange material:
This subclass is indented under subclass 836. Subject matter in which one of the agents serves to heat or cool a material involved in the process or in which the agent dissolves an entire hydrocarbon feedstream.

838 Resolution of feed into more than two different components:
This subclass is indented under subclass 836. Subject matter wherein three or more different materials, contained in the feedstock to the process, are separated from each other.

(1) Note. Each of the three components may be hydrocarbon, as in the separation of an aromatic, an olefin, and a paraffin contained in the feed, or one or more may be a nonhydrocarbon, such as in removing sulfur-containing and color-forming impurities, separately, from a paraffin, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
802+, for a process wherein a feedstock is separated and one of the components is removed by a phenomenon other than addition of an extraneous agent.

839 Later agent disengages earlier, e.g., decomplexing agent, etc.:
This subclass is indented under subclass 836. Subject matter in which a later agent is contacted with the product of contacting an earlier agent with the feedstock or feedstock component, e.g., a complex, an extract phase, etc., to reverse the original interaction and release hydrocarbon and the earlier agent.

(1) Note. Where merely the subcombination step or steps of disengagement of a hydrocarbon from a compound or complex is claimed, e.g., decomplexing a Werner complex, the process is considered to be a synthesis processs not a purification process for subclasses 800+.

840 Later agent is hydrocarbon:
This subclass is indented under subclass 839. Subject matter in which a later agent which disengages an earlier agent is a hydrocarbon.

(1) Note. Patents appearing in this subclass are not cross-referenced to subclass 867.

841 Hi:
This subclass is indented under subclass 833. Subject matter wherein the added agent is hydrogen.

SEE OR SEARCH THIS CLASS, SUBCLASS:
250+, for processes of adding hydrogen to an unsaturated bond, especially subclasses 258+ for hydrogenation of an unsaturated bond of a contaminant.

(1) Note. "Hydrodesulfurization" processes are proper for placement in this subclass.

842 HF and another fluoride:
This subclass is indented under subclass 833. Subject matter in which the agent contains hydrogen fluoride and another compound containing fluorine.

SEE OR SEARCH THIS CLASS, SUBCLASS:
702+, for a process of paraffin synthesis in which an HF catalyst is used also as a purifying or separating agent.

843 Ag:
This subclass is indented under subclass 833. Subject matter wherein an extraneous agent contains silver or a compound thereof.

844 By interaction with monoolefin:
This subclass is indented under subclass 843. Subject matter wherein the process involves silver or a silver compound interengaging a monoolefin from the feed, e.g., by dissolving monoolefin, forming a complex with monoolefin, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
820+, for a separation process wherein silver or a silver compound in solid form, e.g., firmly held on a support, etc., is described as adsorbing or absorbing an unsaturated hydrocarbon.

845 Cu:
This subclass is indented under subclass 833. Subject matter wherein an extraneous agent contains copper or a compound thereof.

846 Ammoniacal, e.g., Cu ammonium acetate (CAA), etc.:
This subclass is indented under subclass 845. Subject matter wherein ammonia is present in the agent with copper, for example, in the form of a copper and ammonium salt, an organic amine mixed with a copper compound, etc.

847 Triple-bond compound separated:
This subclass is indented under subclass 846. Subject matter wherein the agent, e.g., CAA, etc., is added for separation or purification of acetylene or a substituted acetylene.

SEE OR SEARCH THIS CLASS, SUBCLASS:
830, for a separation process in which copper ammonium acetate in solid form, e.g., firmly held on a support, etc., is described as absorbing or adsorbing an unsaturated hydrocarbon.

SEE OR SEARCH CLASS:
48, Gas: Heating and Illuminating, for the preparation of an acetylene-containing mixture from carbides by decomposition with water.
95, Gas Separation: Processes, subclass 238 for processes of gas separation in which an alkyne (e.g., acetylene, etc.) is sorbed in a liquid.
423, Chemistry of Inorganic Compounds, particularly subclasses 245.1+ for a process wherein an initially gaseous or vaporous mixture is treated to remove or change one of the components by a chemical reaction.

848 Plural metal or nonhalide Cu compound-containing:
This subclass is indented under subclass 845. Subject matter wherein the extraneous material is a compound containing copper and another metal or is a copper compound containing no halogen.

849 Cu halide with added material other than water:
This subclass is indented under subclass 845. Subject matter in which the extraneous agent contains copper halide and another material, the material being other than merely water.

850 Group VII or VIII transition metal-containing e.g., werner complex formulation, etc.:
This subclass is indented under subclass 833. Subject matter wherein an extraneous agent contains manganese, iron, cobalt, nickel, technetium, ruthenium, rhodium, palladium, rhenium, osmium, iridium, or platinum, or a compound thereof.

SEE OR SEARCH THIS CLASS, SUBCLASS:
817, for a process wherein Werner complex-forming material in liquid state is added to a liquid mixture to be separated and the mixture is cooled to form a separatable solid.
820+, 830 especially, for a process wherein a mixture is separated by use of a solid Werner complex material which sorbs a component of the mixture and is regenerable by desorption.

851 Group III nontransition element-containing:
This subclass is indented under subclass 833. Subject matter wherein an extraneous agent contains boron, aluminum, gallium, indium, or thallium or a compound thereof.

852 Al:
This subclass is indented under subclass 851. Subject matter in which the agent contains aluminum in free or combined form.

(1) Note. Often the agent is a catalyst containing alumina or aluminum halide.

853 Alkaline metal-containing:
This subclass is indented under subclass 833. Subject matter wherein an extraneous agent contains lithium, sodium, potassium, rubidium, cesium, beryllium, magnesium, calcium, strontium, or barium or a compound thereof.

854 Elemental metal, oxide, or hydroxide:
This subclass is indented under subclass 853. Subject matter in which the agent is in the form of free or uncombined metal, an oxide, or a hydroxide of the metal.

855 Metal-containing:
This subclass is indented under subclass 833. Subject matter wherein an agent contains metal in free or combined form.

(1) Note. Metals appropriate for placing patents in this subclass include transition metals of periodic table groups IIB, IIIB, IVB, VB, and VIB, germanium, gold, tin, lead, arsenic, antimony, and bismuth.

856 S-containing:
This subclass is indented under subclass 833. Subject matter wherein an agent contains sulfur in free or combined form.

857 S dioxide, sulfolane, or sulfolene:
This subclass is indented under subclass 856. Subject matter wherein an agent is one of the sulfur-oxygen compounds, sulfur dioxide (SO_2), sulfolane (tetrahydrothiophene-1, 1-dioxide (Fig 1) or sulfolene (dihydrothiophene-1, 1-dioxide (Fig. 2)

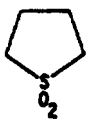


FIGURE 1

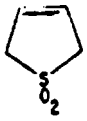


FIGURE 2

858 Sulfuric acid:
This subclass is indented under subclass 856. Subject matter wherein an agent is H_2SO_4.

859 Interaction with tertiary olefin:
This subclass is indented under subclass 858. Subject matter wherein the purification or separation is accomplished by interengagement of the sulfuric side with an olefin which has a double bond attached to a tertiary carbon atom, that is, a carbon atom which bears no hydrogen, the interengagement being a reaction between the two materials, a dissolving of one in the other, etc.

860 N-containing:
This subclass is indented under subclass 833. Subject matter wherein an agent contains nitrogen.

861 Ammonia:
This subclass is indented under subclass 860. Subject matter wherein an agent is NH_3 or NH_4OH.

862 Carbonyl moiety-containing:
This subclass is indented under subclass 860. Subject matter wherein an agent contains the =C=O functional grouping, e.g., and acid, an aldehyde, a ketone, etc.

SEE OR SEARCH CLASS:
260, Chemistry of Carbon Compounds, subclass 96.5 for the formation of a urea adduct, even when the formation of such adduct is merely for the purpose of purifying a hydrocarbon.

863 Interaction with aromatic:
This subclass is indented under subclass 960. Subject matter wherein the purification or separation is accomplished by interengagement of an agent with an aromatic compound, e.g., by reaching therewith dissolving it, etc.

864 Organic agent:
This subclass is indented under subclass 833. Subject matter wherein the agent is a carbon compound characterized by the presence in a molecule thereof of two carbon atoms bonded together or one atom of carbon bonded to at least one atom of hydrogen or halogen or one atom of nitrogen by a single or double bond.

(1) Note. An organic compound under this definition is as defined in the class definition of Class 260, Chemistry of Carbon Compounds, as qualified by (34) Note therein.

(2) Note. The organic part may be present as the organic radical part of a compound or as the organic portion of a mixture of organic and inorganic materials.

865 Heterocyclic or polymeric:
This subclass is indented under subclass 864. Subject matter wherein the agent has a molecular structure which includes a ring or cyclic configuration, which ring contains other than carbon atoms, or wherein the agent is of indefinite molecular weight, greater than 150, and made by reating with each other smaller molecules having definite identities.

(1) Note. The anhydride of a dicarboxylic acid often is a heterocyclic compound, e.g., maleic anhydride, o-phthalic anhydride, etc.

866 Acid, anhydride, ester or ether:
This subclass is indented under subclass 864. Subject matter wherein an agent contains the grouping -C--C- or -C-O-.

867 Hydrocarbon:
This subclass is indented under subclass 864. Subject matter wherein an agent contains only carbon and hydrogen in its molecule.

SEE OR SEARCH THIS CLASS, SUBCLASS:
840, for a purification or separation process wherein a hydrocarbon is used to disengage a previously added agent from a hydrocarbon.

868 Inorganic O-containing agent:
This subclass is indented under subclass 833. Subject matter in which an extraneous agent added to purify, separate, or recover the hydrocarbon is inorganic and contains oxygen, e.g., water, phosphoric acid, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:
15, for a hydrocarbon separation process involving the formation of a hydrocarbon hydrate.

899 MISCELLANEOUS PROCESS, E.G., INDETERMINATE MODIFICATION OF A PROPERTY, STORAGE, TRANSPORTAION, ETC.:
This subclass is indented under the class definition. Subject matter not otherwise provided for.

(1) Note. A hydrocarbon synthesis or purification process is placed in this subclass (899) only when the type of hydrocarbon synthesized or the purification mechanism employed cannot be determined from the claims, specification, or state of the art.

SEE OR SEARCH THIS CLASS, SUBCLASS:
1, for a “preserving” or “storing” process which involves no more than merely blending a preservative with a hydrocarbon.

SEE OR SEARCH CLASS:
62, Refrigeration, subclasses 600+ for manufacture of a solidified or liquefied gas product from a gas; subclasses 45.1+ for handling of such product; and subclasses 56+ for a cooling process, e.g., quenching, per se.
137, Fluid Handling, subclass 13 for a process in which the flow of a fluid is affected by the addition of material or energy.
406, Conveyors: Fluid Current, subclasses 46 and 197 for a process of transporting a fluid.

CROSS-REFERENCE ART COLLECTIONS

900 Rehabilitation of H acceptor:
Collection of patents (under unnumbered subclass CATALYST AND RECYCLE CONSIDERATIONS) concerned with dehydrogenation to produce a hydrocarbon compound, in which a hydrogen acceptor compound is employed and is rehabilitated for reuse in the process, the rehabilitation usually comprising oxidation of the reduced acceptor compound.

901 With recycle, rehabilitation, or preservation of solvent, diluent, or mass-action agent:
Collection of documents (under unnumbered subclass CATALYST AND RECYCLE CONSIDERATIONS) (a) to prevent loss of, (b) to restore effectiveness, or (c) to return to a stage of a process, either directly to indirectly, from which it has been withdrawn from use in that stage, a material which is a solvent or diluent or an agent, usually a normally undesired by-product of the process, which regulates the equilibrium of the process to favor production of desired product.

(1) Note. Recycled effluent from a process which is added to a feedstock in an amount designed to control reaction time is considered to be a solvent or diluent.

SEE OR SEARCH THIS CLASS, SUBCLASS:
702, for a saturated compound synthesis process in which a material used as a solvent in one stage of a process is used as a catalyst in another part of the process before return to the original stage.
954, for other processes which exploit mass-action phenomena.

902 Recycle of solvent and catalyst:
This subclass is indented under subclass 901. Collection of documents which disclose recycle of both a solvent and a catalyst.

SEE OR SEARCH THIS CLASS, SUBCLASS:
706, for a saturated compound synthesis process wherein a reactor effluent component is added to a catalyst as an agent for rehabilitation or recycle.

903 With hydrocarbon recycle to control synthesis reaction, e.g., by cooling, quenching, etc.:
Collection of documents (under unnumbered subclass CATALYST AND RECYCLE CONSIDERATIONS) which disclose control of a synthesis reaction by recycle of a hydrocarbon effluent of the reaction.

SEE OR SEARCH CLASS:
62, Refrigeration, subclasses 56+ for a quenching process, per se.

904 Catalyst rehabilitation by reversion from different compound:
Collection of documents (under unnumbered subclass CATALYST AND RECYCLE CONSIDERATIONS) which disclose rehabilitation of a catalyst, including synthesis of or decomposition of a nonhydrocarbon compound containing an essential component of the catalyst.

(1) Note. The catalyst may be returned to reaction in a different form from that originally employed in the reaction, e.g., as an alkyl chloride rather than the HCI originally used.

SEE OR SEARCH THIS CLASS, SUBCLASS:
311, for plural serial diverse syntheses in which one synthesis rehabilitates the catalyst which catalyzes the other synthesis.
710, for a similar process which relates only to an alkylation reaction which synthesizes saturated compounds.

905 By-product conversion to feed:
Collection of documents (under unnumbered subclass CATALYST AND RECYCLE CONSIDERATIONS) which disclose the conversion of a synthesis effluent component which is undesired in the product to a material similar to a component of the original feedstock.

906 Catalyst preservation or manufacture (e.g., activation, etc.) before use:
Collection of documents (under unnumbered subclass CATALYST AND RECYCLE CONSIDERATIONS) which disclose an optimum method of preparing a catalyst for use in a particular reaction or a method of preventing catalyst loss in a process.

910 Exploiting or conserving heat of quenching, reaction, or regeneration:

Collection of documents (under unnumbered subclass HEAT CONSIDERATIONS) which disclose the return of heat generated by a reaction or by catalyst regeneration or absorbed by the quenching of reactants to the process, e.g., to warm feedstock, to provide energy for subsequent distillation, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

402, 503, 535, 602, and 634, for aromatic synthesis, olefin addition, alkyne synthesis, diolefin synthesis, and unsaturated compound synthesis, respectively, using similar techniques.

911 Introducing, maintaining, or removing heat by atypical procedure:

Collection of documents (under unnumbered subclass HEAT CONSIDERATIONS) disclosing the heating of a material, the cooling of a material, or the prevention of either, using a fuel, refrigerant, heat-exchange material, procedural step, etc., which is not standard industrial practice.

(1) Note. The following is a summary of Patent and Trademark Office classes concerned with changing temperature or preventing temperature change.

SEE OR SEARCH CLASS:

62, Refrigeration.
110, Furnaces
122, Liquid Heaters and Vaporizers.
126, Stoves and Furnaces.
165, Heat Exchange.
219, Electric Heating.
236, Automatic Temperature and Humidity Regulation.
237, Heating Systems.
373, Industrial Electric Heating Furnaces.
431, Combustion.
432, Heating.

912 Molten material:

This subclass is indented under subclass 911. Subject matter which discloses the use of a normally solid material which has been liquefied by heat.

SEE OR SEARCH THIS CLASS, SUBCLASS:

634+, for use of a molten heat carrier in the synthesis of a monoolefin.

913 Electric:

This subclass is indented under subclass 911. Subject matter which discloses the use of electricity for heating or cooling.

SEE OR SEARCH CLASS:

136, Batteries: Thermoelectric and Photoelectric, subclasses 200+ for methods and devices which convert heat directly to electricity thereby creating a cooling effect.

914 Phase change, e.g., evaporation, etc.:

This subclass is indented under subclass 911. Subject matter which discloses temperature regulation due to the heat released or consumed by change of a material from the gaseous, liquid, or solid state to another of these states.

SEE OR SEARCH THIS CLASS, SUBCLASS:

715, for autorefrigeration in an alkylation process to produce a saturated compound.

920 Using apparatus of recited composition:

Collection of documents (under unnumbered subclass APPARATUS CONSIDERATIONS) wherein a process recites the composition of apparatus employed in the process,e.g., a stainless steel reactor wall, a refractory ceramic baffle, etc.

(1) Note. Materials which move through or are readily removable from the apparatus, e.g., catalyst beds, are not considered part of the apparatus for this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

403, 503, 537, and 636, for processes for synthesizing aromatics, olefin polymers, acetylenes, and monoolefins, respectively, wherein the composition of the apparatus used is specified.
921+, for a collection of patents in which the effectiveness of a process depends

upon the use of apparatus having a defined structure configuration, independent of the composition of the structure.

921 Using recited apparatus structure:
Collection of documents (under unnumbered subclass APPARATUS CONSIDERATIONS) which discloses the effectiveness of a process as being dependent upon the use of a particular configuration of apparatus.

(1) Note. The following expressions generally are not considered sufficient to warrant placement of a document in this or indented subclasses unless a dimension is recited--

annular zone; acetylene converter; converter; elongated; multistage reactor; pyrolysis reactor; reactor regenerative furnace; vessel; zone

SEE OR SEARCH CLASS:
422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, appropriate subclasses for apparatus employed in synthesis processes of this class.

922 Reactor fluid manipulating device:
This subclass is indented under subclass 921. Subject matter wherein the apparatus is a device, part of a synthesis reactor, which serves to change the condition of a fluid in an active way, such as an impeller, or in a passive way, such as a perforated plate.

SEE OR SEARCH THIS CLASS, SUBCLASS:
720, for this subject matter used in connection with alkylation to synthesize a saturated compound.

SEE OR SEARCH CLASS:
137, Fluid Handling, appropriate subclasses for methods and apparatus in general for mixing and other manipulation of fluids.

923 At reactor inlet:
This subclass is indented under subclass 922. Subject matter wherein the device is at that point where feed or an extraneous agent enters a reactor.

924 Reactor shape or disposition:
This subclass is indented under subclass 921. Subject matter wherein the configuration is that of the reactor or the relationship of the reactor to its surroundings, e.g., other elements of apparatus, the earth, etc.

925 Dimension or proportion:
This subclass is indented under subclass 924. Subject matter wherein a numerical dimension or the relationship between two dimensions of the reactor is disclosed as contributing to the effectiveness of the process.

926 Plurality or verticality:
This subclass is indented under subclass 924. Subject matter wherein the effectiveness of the process is disclosed as depending upon having a vertical reactor or having more than one reactor.

(1) Note. Where the reactor is described as having a plurality of vertically spaced components, e.g., catalyst beds, the verticality of the reactor is assumed.

930 Process including synthesis of nonhydrocarbon intermediate:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATION) disclosing plural-step processes for the synthesis of a hydrocarbon in which a step synthesizes a compound containing more than carbon and hydrogen atoms from which the hydrocarbon product is synthesized.

SEE OR SEARCH CLASS:
260, Chemistry of Carbon Compounds, appropriate subclasses for the synthesis of nonhydrocarbon organic compounds, per se.

931 Metal-, Si-, B-, or P-containing, e.g., grignard, etc.:
This subclass is indented under subclass 930. Subject matter wherein the intermediate contains a metal, silicon, boron, or phosphorus.

932 Carboxyl-containing, e.g., acid, etc.:
This subclass is indented under subclass 930. Subject matter wherein the intermediate contain the group -C--.

933 N-containing:
This subclass is indented under subclass 930. Subject matter wherein the intermediate contains nitrogen.

934 Chalcogen-containing:
This subclass is indented under subclass 930. Subject matter wherein the intermediate contains oxygen, sulfur, selenium, or tellurium.

935 Halogen-containing:
This subclass is indented under subclass 930. Subject matter wherein the intermediate contains chlorine, bromine, fluorind, or iodine.

940 Opening of hydrocarbon ring:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) which disclose a hydrocarbon synthesis in which a hydrocarbon moiety is converted from a cyclic moiety to an acyclic moiety.

SEE OR SEARCH THIS CLASS, SUBCLASS:
353+, 601 and 671, for manufacture of alicyclic, diolefin and monoolefin compounds, respectively, by opening a hydrocarbon ring.

941 Isotope exchange process:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) which disclose the replacement of a carbon atom or a hydrogen atom of a hydrocarbon compound by a specified or unusual isotope of carbon or hydrogen, e.g., carbon-14, deuterium, etc.

SEE OR SEARCH CLASS:
23, Chemistry: Physical Processes, subclass 230.6 for test methods involving isotope exchange.

942 Production of carbonium ion or hydrocarbon free radical:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) which disclose the inducement of a transitory, highly reactive high-energy state in a hydrocarbon, in which state the hydrocarbon has at least one unpaired electron or has a net electric charge.

943 Synthesis from methane or inorganic carbon source, e.g., coal, etc.:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) which disclose synthesis of hydrocarbons from CH_4, elemental carbon, or an inorganic carbon compound.

(1) Note. Inorganic compounds are those which do not fall under the definition of carbon compounds given in the class definition of Class 260 and also the following compounds which are considered inorganic: hydrocyanic acid, cyanogen, isocyanic acid, cyanamide, cyanogen halides, isothiocyanic acid, fulminic acid, and metal carbides.

SEE OR SEARCH THIS CLASS, SUBCLASS:
538+, for acetylene manufacture from methane.

SEE OR SEARCH CLASS:
208, Mineral Oils: Products and Processes, subclass 400 for a process in which coal or other solid mineral material is converted to a liquid mixture of materials similar to petroleum or a petroleum fraction.
518, Chemistry: Fischer-Tropsch Processes; or Purification or Recovery of Products Thereof, for the manufacture of hydrocarbons from hydrogen and carbon oxides.

944 Radiation-resistant composition:
Collection of documents (under unnumberes subclass SPECIAL CHEMICAL CONSIDERATIONS) disclosing hydrocarbon compounds or mixtures of such compounds which are susceptible to fewer changes in physical or chemical properties under the influence of radiant energy, whether visible or invisible, including that radiant energy produced by atomic disintegration, fission, or fusion.

945 Product is drying oil:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) disclosing a hydrocarbon product which upon aging in a particular environment, e.g., air, etc., becomes a solid material of indefinite molecular weight.

SEE OR SEARCH THIS CLASS, SUBCLASS:
507, for a process of making a polyunsaturated olefin hydrocarbon by polymerization. The products of such processes frequently are disclosed as having utility as a drying oil. Patents classified in subclass 507 are not cross-referenced here.

SEE OR SEARCH CLASS:
208, Mineral Oils: Processes and Products, subclass 1 for a synthetic drying oil derived from a mineral oil.

946 Product is waxy polymer:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) disclosing a hydrocarbon product polymer which is described as "waxy", this term apparently meaning a solid material without the tensile properties usually associated with a synthetic resin.

SEE OR SEARCH THIS CLASS, SUBCLASS:
446+, and 502+, for processes which yield waxy products.

947 Terpene manufacture or recovery:
Collection of documents (under unnumbered subclass SPECIAL CHEMICAL CONSIDERATIONS) disclosing the synthesis or purification of terpentine or other terpene materials.

SEE OR SEARCH THIS CLASS, SUBCLASS:
355, for terpene synthesis by isomerization and the defintions and notes thereto for a listing of various C_{10} terpenes.

950 Prevention or removal of corrosion or solid deposits:
Collection of documents (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) disclosing procedures for preventing the deterioration of apparatus contacted by a hydrocarbon or an agent used in hydrocarbon processing or for preventing solid products from forming or accumulating on such apparatus.

SEE OR SEARCH CLASS:
208, Mineral Oils: Process and Products, subclasses 47 and 48+ for similar procedures used in chemical conversion of petroleum hydrocarbons.

951 Reaction start-up procedure:
Collection of documents (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) disclosing preparations for getting a synthesis reaction on-stream or the preliminary steps used before a reaction becomes continuous.

952 Reaction stopping or retarding:
Collection of documents (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) disclosing procedures for preventing or discontinuing an unwanted reaction in hydrocarbon processing.

SEE OR SEARCH THIS CLASS, SUBCLASS:
1+, for a reaction stopping or retarding procedure which comprises no more than blending a stabilizer or preservative with the hydrocarbon.

953 Pulsed, sonic, or plasma process:
Collection of documents (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) disclosing the application to material of a regular rhythmic vibration, a sudden burst of motive energy, or containment or transportation of material by use of a high energy field.

SEE OR SEARCH THIS CLASS, SUBCLASS:
539, and 540, for an acetylene synthesis process which involves containment of reactant within a high energy gaseous envelope.

954 Exploiting mass-action phenomenon:
Collection of documents (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) disclosing a modification of a reac-

tion system including the addition to or removal from a reaction zone of a material other than a catalyst or solvent to shift the equilibrium state of the reaction in a desired direction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

901, for a collection of documents disclosing the recycle of a mass-action agent.

955 Specified mixing procedure:

Collection of documents (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) disclosing procedures for achieving desired contact among fluent materials.

SEE OR SEARCH THIS CLASS, SUBCLASS:

720, for a saturated compound alkylation synthesis procedure involving specified fluid flow.

922+, for a reactor fluid manipulating device.

956 Condition-responsive control and related procedures in alicyclic synthesis and purification:

Cross-reference collection of purification and alicyclic synthesis processes (under unnumbered subclass MISCELLANEOUS CONSIDERATIONS) involving a step of taking a measurement, sensing a condition, or making a test, or controlling an operating condition of the process in response to a condition different from that controlled, e.g., flow rate of feed in response to temperature of effluent, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

263, 401, 501, and 701, for similar procedures employed in hydrogenation and the synthesis of aromatic, unsaturated, and saturated hydrocarbon compounds, respectively.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for processes and apparatus for making a measurement or test of any kind not claimed in combination with synthesis of an organic compound and not elsewhere classifiable, and the class definition thereof for the identification of other classes concerned with testing.

436, Chemistry: Analytical and Immunological Testing, subclasses 1+ for a test or measurement associated with a chemical reaction not elsewhere classifiable, or analysis by chemical methods of organic material or the combination of measuring and testing with methods of regulating a reaction.

END